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THE GENERAL MAGNETIC SURVEY OF THE EARTH*

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The famous mathematical physicist Stokes is said to have remarked that we must not forget that the chief instrument of investigation, the mind, is itself the object of research. Possibly no one means or instrumentality has contributed more powerfully to discoveries and research in the science represented by this joint gathering tonight—geography—than the magnetic compass. You have accorded me the privilege of showing briefly this evening how this instrument of investigation has itself been made the object of a research not only coextensive with the boundaries of the planet we inhabit but even transcending them. We shall find, as we pursue our studies of that mysterious force called the earth's magnetism, that we are, indeed, limited by no well-defined boundary as, for example, the earth's surface, but are carried far out into limitless space and even to the sun itself.

Professor J. A. Fleming closed his suggestive popular address before the British Association for the Advancement of Science, at Liverpool in 1896, on "The Earth, A Great Magnet," as follows:

"To us as a maritime nation, to you who are inhabitants of a maritime city, the progress of a knowledge of terrestrial magnetism, the improvements in the compass, the study of the causes of error in iron ships, in short, everything connected with the use and evolution of the compass, is of unspeakable importance. * * *

"That great empire which has its center in these islands, but its dominions

*The evening lecture given before the first joint meeting of the American Geographical Society and the Association of American Geographers in New York, April 3, 1914; illustrated by lantern slides.

scattered over distant seas, has been built up primarily on the art of navigation, in which the magnetism of the earth is a central fact. Neither its world-wide commerce, nor the naval power which defends its coasts, could exist for a day without the aid of the magnetic compass. But our globe, as it spins through space, is clothed, as it were, in a gossamer garment woven of lines of magnetic force, and this little trembling needle serves as a sensitive finger, whereby we track out the path of these invisible clues, and, confidently determining our direction, though wandering over wide waters, wrapped, it may be, in darkness or in storm, are enabled thereby to establish a continual intercourse between all portions of the habitable globe."

The Earth's Lines of Magnetic Force

Gilbert in 1600 had already spoken of the rays of magnetic force emanating in all directions from the lodestone's center, and thus forming an "orb" or "sphere of influence" around "that great magnet, the earth." "Like as the tender mother draws the suckling babe to her breast," runs a Chinese saying, "so does the stone draw unto itself the all-conquering iron." No wonder then that the lodestone has also been called the lovestone; indeed the French still call the magnet "l'aimant." And its mysterious sphere of influence —Gilbert's "orbis virtutis," Fleming's "gossamer garment, woven of lines of magnetic force," surrounding and extending far beyond the visual boundary of the lodestone, endowed the latter, from the earliest times, with many peculiar properties and gave rise to many queer superstitious notions.

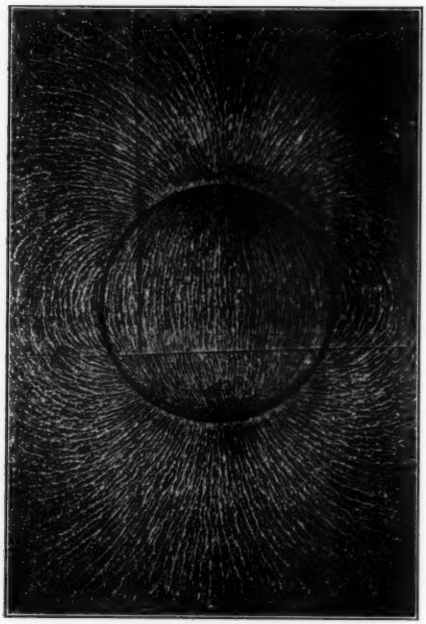


Fig. 1—Lines of force of a uniformly magnetized sphere. [The earth's magnetic field is not of this simple character; its magnetic poles are, on the average, 1,200 miles distant from its geographic poles and they are not diametrically opposite each other. A straight line connecting the earth's magnetic poles would pass through the earth 750 miles off from the center.]

The term "lines of magnetic force" for the paths traced out by the iron filings strewn around a magnetized body, we owe to Michael Faraday. The many brilliant and fruitful researches in magnetism and electricity by this indefatigable worker during the first half of the last century were in no small measure inspired by this happy conception of a "field" and "lines of force" about a magnet.

Picture then to yourselves these lines of magnetic force (Fig. 1) starting out from the earth's south magnetic pole and, after sweeping far out into space, curving gracefully around high above our equator and reentering finally at the north magnetic pole. Recall now that, while these lines cannot ordinarily be seen, they are made apparent to us by the beautiful phenomenon of polar lights, whose flickering flames and shooting rays arrange themselves in accordance with the earth's lines of magnetic force, and "dance in rhythm with the quivering needle." What is the origin of these lights? According to the latest theories, it is believed that when the tiny electrically-charged particles, continually being given off by our sun, come within reach of these lines of force, they are made to wrap themselves around them, descending into the polar regions along a spiral staircase, as it were. Before reaching the earth's surface, however, at heights of about twenty-five to three hundred miles, they are brought into luminescence, and thus we have the aurora borealis in the arctic regions and the aurora australis in the antarctic.

Who knows what part the earth's lines of magnetic force may not play, in the economy of nature, by carrying away and thus preventing an over-charge of electrified particles, shot off by the sun, from penetrating so low down towards the earth's surface as to be, perhaps, not wholly beneficial to man's physical well-being? Thus the earth's magnetic atmosphere, or aura, so to speak, may perform a screening function, with respect to these electrified particles, similar to that of the atmospheric envelope which comes within the ken of the meteorologist, in warding off the meteoric projectiles forever being hurled at us by our celestial neighbors.

We were then right when we surmised that our studies of the earth's magnetism, or what is the same thing, of the earth's surrounding magnetic field as traced out by its lines of magnetic force, carry us "far out into limitless space and even to the sun itself." And as we progress in our subject let us ever keep before us Professor Fleming's beautiful imagery: "The earth spinning through space, clothed as it were, in a gossamer garment, woven of lines of magnetic force." We shall find that the earth is not alone in this respect.

XUM

Our duty, at present, then, is to map completely, over the earth's immediate surface, its lines of magnetic force, though later we may attempt to do the same in ocean depths and atmospheric heights. We must ascertain, at each place of observation, whether the vertical plane passing through any given line of force coincides with a meridional plane of the earth and, if not, what the angle of divergence is; or, in other words, we must measure the angle which the direction pointed out by a compass needle makes with a true north and south line. This angle is reckoned as so many degrees east or west of north and is known to the mariner and surveyor as the "variation of the compass," and to the man of science, who finds need for more precise terms, as the magnetic declination. In the United States, for example, the magnetic declination varies at present from 22° West, in Maine, to 23° East, in Oregon.

But we also must know the steepness of the lines of force, that is, the angle at which they enter or emerge from the earth. This angle is measured with the aid of the well-known instrument, the dip-circle. The angle which the dipping needle makes with the horizon, if the vertical plane of the dip-circle passes through the magnetic meridian, *i.e.*, the direction defined by the compass-needle, is called the magnetic inclination or dip. At the north magnetic pole, the dip-needle stands vertical with the north end down, whereas at the south magnetic pole, the south end is down. Half way between, at the so-called magnetic equator, a dip-needle sets itself with neither end up or down but, instead, lies truly horizontal.

Knowing both the magnetic declination and the magnetic inclination, we are able to map out completely the direction everywhere assumed by the earth's lines of magnetic force. But this is not sufficient either for theory or for the practical application of the earth's magnetic phenomena to the everyday affairs of man. Thus, in order to correct properly a compass on a modern ironclad, or in other words, in order to counteract effectively on the compass the disturbing influence of the ship's own magnetism, due to the iron and steel entering into her construction, we must know, in all the oceans traversed, how strong or weak is the force exerted by our earth-magnet. Hence, our third and final element of observation is the so-called "intensity of the earth's magnetic field."

The Earliest Observations and The Earth's Changing Magnetism

It was a discovery respecting the direction assumed by the compass-needle which gave definition to the first boundary line of

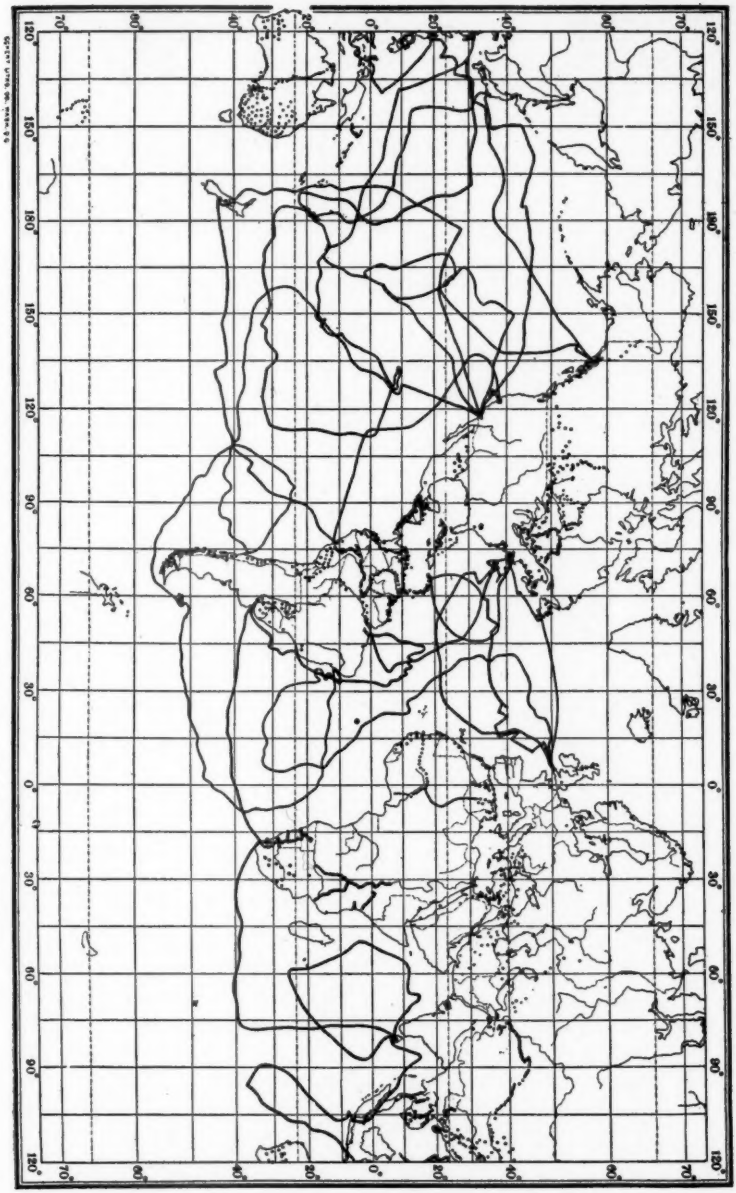


FIG. 2—Status of the field operations of the Department of Terrestrial Magnetism, 1905–1913.

great political importance. On September 13, 1492, during that memorable first voyage of Columbus, when they were off one of the islands of the Canaries, the compass, to the great consternation of the sailors, was found to point west of the polar star. From the time of embarking from the Spanish coast, the compass had been pointing east of that star, hence east of true north. To quiet the superstitious sailors, it is said that the doughty admiral shifted the compass card with respect to the needle so that the compass bore true again and he thus led them to believe that it was the star that varied its position and not the compass its direction. The fact is that during this voyage they crossed, in the meridian somewhat west

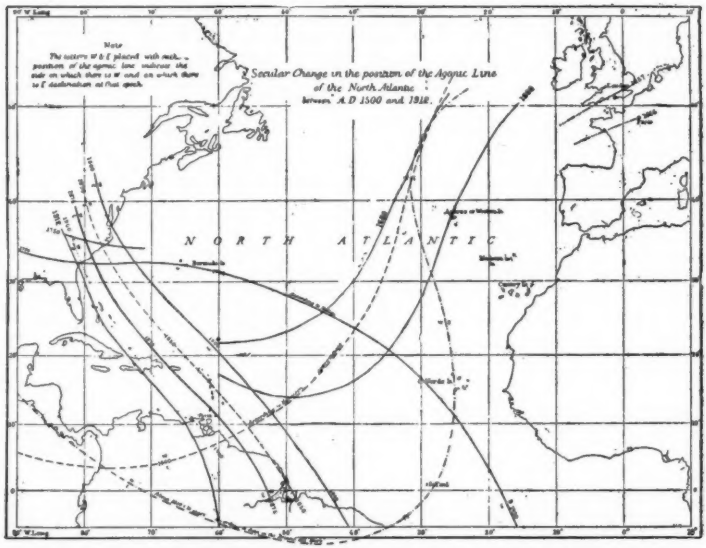


FIG. 3—Secular change in the position of the agonic line of the North Atlantic between A.D. 1500 and 1912. Chiefly after C. A. Schott and W. van Bemmelen.

of Fayal, one of the Azores, the agonic line, or line of no magnetic declination or variation of the compass, along which the magnetic needle sets itself exactly north and south (Fig. 3). At Palos, the port from which Columbus sailed, the magnetic declination was about half a point east and diminished to zero when the agonic line was crossed. Then the compass pointed to the west of north by an ever-increasing amount until in about mid-ocean the bearing was as much as a point. From that time, it diminished and when at last land was reached, the compass-bearing was about half a point west.

This line along which the needle pointed exactly north and south, in the time of Columbus and Cabot, was believed to be a convenient line, "given by nature herself" from which to reckon longitude and it figured prominently in history for many years as the line of demarcation between the rival kingdoms of Portugal and Castile. Alas, however, for human invention, it was soon found that this line, far from being straight, is very devious, indeed, and, what is worse, it is not even fixed in position, having now disappeared almost entirely in the North Atlantic Ocean, though it may come back again in the distant future.

Just who first discovered that a compass, except at few places, does not point true north and south, can not be definitely ascertained. It would appear from some early sun-dials, that this fact may have been discovered before, or at least independently of, the voyage of Columbus. However, it can not be denied that it was his voyage which first definitely showed that the compass, contrary to the poet's line—"True as the needle to the pole,"—usually does not point to the true north but that the amount of divergence varies from locality to locality. The necessity in navigation for measuring the angle by which the north end of the compass points east or west of north, thus became definitely apparent in 1492, and hence this must be regarded as the year of the birth of the science of terrestrial magnetism, which has for its primary object the measurement of the earth's magnetic elements, *i.e.*, the making of so-called magnetic surveys.

Probably the first systematic magnetic survey, though it was but a partial one in that it concerned itself with only one element, the magnetic declination, was that under the leadership of the famous English astronomer, Edmund Halley, known to most of us as the discoverer of Halley's comet which reappeared a few years ago. Under orders from the British Government, between 1698 and 1700, Halley cruised up and down the Atlantic in command of the sailing ship, the *Paramour Pink,* and diligently observed the "variation of the compass" and "the true situation both of longitude and latitude of the ports" he visited. He laid down the result of his labors on a chart, sometimes briefly called the "Tabula Nautica," which was the first of its kind. Quoting Halley: "What is here properly *New* is the *Curve Lines* drawn over the several Seas, to show the degrees of the *Variation* of the *Magnetical Needle,* or *Sea-Compass.*"

Halley's chart and its successors soon won among mariners well-deserved popularity, but by about the middle of the eighteenth

XUM

century, or fifty years after the first issue, in 1701, the "Curve Lines" were found to have changed so much as to require their complete reconstruction. For "the magnetic state of our globe is one of swift and ceaseless change and but a few years suffice to alter it materially."

This "swift and ceaseless" change in the earth's magnetic state was strikingly made evident when, in the fall of 1909, there set out from the shores of Newfoundland another sailing vessel, of which we shall have more to tell later. Beset by October gales she, nevertheless, unerringly followed, all the way to England, very nearly the identical track pursued by Halley's vessel 210 years before, and like Halley's vessel was also bent on measuring the "variation of the compass." Such great changes were found that, if the latter had attempted to follow the same magnetic courses as those of the *Paramour Pink,* instead of coming to anchor in the quaint, old harbor of Falmouth, her landfall would have been somewhere on the northwest coast of Scotland.

Magnetic Survey of the Oceans

Though many noteworthy expeditions could be mentioned which, in the interim between Halley's and those of the Carnegie Institution of Washington, obtained credible magnetic data incidental to other work or objects, and while also naval vessels of various nations have contributed, from time to time, useful information, during all these two hundred years no vessel had been sent out by any country for the sole purpose of making magnetic observations. Thanks to the munificence of one, well-known to all of you, it became possible, on April 1, 1904, just ten years ago, for the Trustees of the Carnegie Institution of Washington to establish a department which could undertake as its chief task a systematic magnetic survey not only of the oceans, but of the whole earth, on a scale and with a dispatch not heretofore possible.

After some preliminary investigations, it became evident that the first ocean magnetic survey to be undertaken was that of the Pacific, for it was in this region that the Halleyan "Curve Lines" on which mariners depended, were known, because of the paucity of data, to be more or less uncertain. New instruments had to be in part devised, for our survey was to be far more comprehensive than Halley's could be and was to embrace all the necessary observations for completely defining the direction and intensity of the earth's magnetic force at sea. Time will not permit us to enter into details; suffice it to say that we were ready to embark on our first voyage

in July, 1905, from San Francisco, in a chartered vessel, the *Galilee*, which we had been able to make approximately non-magnetic. During the three years (1905-1908) that the vessel was in commission, her cruises aggregated in length 60,000 miles and extended from Sitka, Alaska, in the north, to Port Lyttelton, New Zealand, in the south.

The *Galilee*, with the changes made, proved to be more non-magnetic than any modern vessel on which magnetic observations had been attempted. It was found that, with our appliances and methods, the results were of such accuracy as to warrant applying the corrections due to the remaining iron in the *Galilee* which, without reconstructing the vessel, could not readily be replaced by non-magnetic metal. These so-called deviation-corrections, though small, were yet, if they were not known, large enough to defeat our purpose to determine the amount of change in the magnetic elements by repeating the observations at the intersections of our tracks, three or five years apart. But to determine such corrections with the requisite accuracy proved to be a laborious process which cost as much, in time and money, as the acquirement of the primary or original quantities themselves. Hence arose the desire for a vessel on which magnetic observations could be made unaffected by any local influence due, for example, to the iron in her construction.

Accordingly, the *Galilee* was returned to her owners in May, 1908, and, with the funds provided by the Carnegie Institution of Washington, the project of building a vessel specially adapted to the varied purposes of ocean magnetic surveys, was undertaken. The designs were prepared by the well-known naval architect of New York, Mr. Henry J. Gielow, following suggestions based upon the experience gained by us during the work of the *Galilee*. The vessel was built by the Tebo Yacht Basin Company of Brooklyn, under the personal supervision of Mr. Wallace Downey. Nearly all materials entering into her construction were obtained in New York or within a distance of about fifteen miles.

Thus the non-magnetic *Carnegie* came into being. Launched in June, 1909, she entered on her maiden cruise of 8,000 miles in the following August. Since then this little vessel has made cruises in the Atlantic, Indian, and Pacific oceans, between the parallels of about 50° N. and 50° S., aggregating in distance four times the earth's circumference; and she will soon leave New York once more, this time for a cruise in the North Atlantic, towards the Norwegian coast and return. Next year, I hope, she will pass through the Panama Canal and enter upon a cruise in southern waters between

XUM

the parallels of about 50° S. and 70° S., where no systematic magnetic work has been done since the memorable voyages of the *Erebus,* the *Terror* and the *Pagoda,* seventy years ago.

The *Carnegie* (Fig. 4) is 155½ feet in length over all, 128⅓ feet on the load-water line, 33 feet beam, draught 13½ feet, displacement about 600 tons, and is built almost entirely of wood fastened together with locust-tree nails, copper and Tobin bronze bolts, and composition spikes. Although she is practically a sailing vessel, brigantine-rigged, she has a small amount of auxiliary power, a producer-gas engine, which, with the exception of the

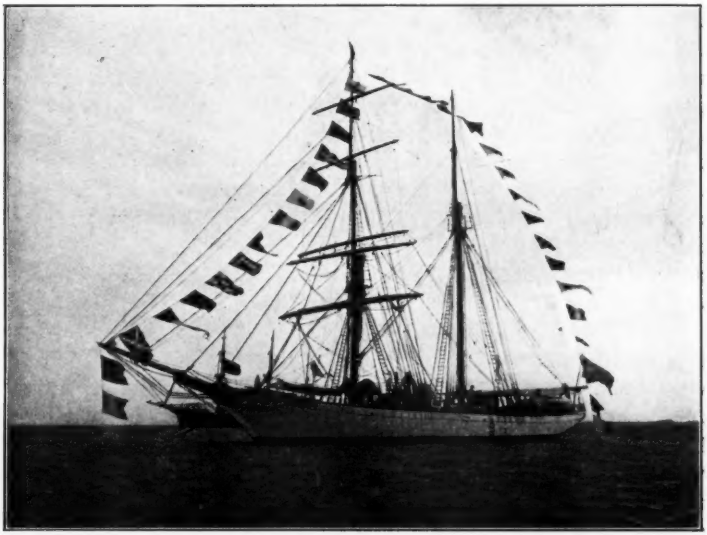


FIG. 4—The *Carnegie* at Bahia, Brazil, May, 1913. Dressed in honor of the port anniversary.

pistons and cams, is wholly built of brass and copper. The small amount of steel, 600 out of 20,000 pounds of metal entering into the construction of the engine, is so far removed from the observing instruments as to have no effect. The anchors, of which there are four, aggregate weight 5,500 pounds, are bronze. The rigging is of hemp, the metal parts being all of bronze or copper. As we could not use iron chains for the anchors, and as a bronze chain of the required strength was too expensive, 11-inch hemp cables, each of 120 fathoms, were adopted; this made it necessary to use the old fisherman windlass.

The three life-boats are non-magnetic, the galley stoves and refrigerating plant of bronze and copper, the sailors' sheath-knives of non-magnetic manganese steel, and our cutlery of Mexican silver. Do you wonder that facetious newspaper reporters have dubbed the *Carnegie* "the most unattractive vessel afloat"? Thomas Hood, in his amusing poem, "The Compass, with Variations," evidently anticipated the *Carnegie*, for he says:

> "They found no gun—no iron—none
> To vary its direction."

And he even remarks: "*Bronzed* mariners were her's to view!"

On the *Carnegie* the instruments are under shelter. The glass dome of the observatory can be revolved like the dome of an astronomical observatory, two of the glass panels being removable, so that both astronomical and magnetic observations may be made with complete protection from wind and weather. Having a vessel in which the deviation-corrections, if any, are on the order of or less than the error of observation, as has been proved by elaborate tests made at various ports, it is now possible to compute the observations on board and know the results within an hour after they are made. On arrival at port, the results are promptly transmitted to the office at Washington, whence they are supplied to the leading hydrographic establishments—to the British Admiralty, the German Seewarte, the U. S. Hydrographic Office, etc. The data of interest to mariners are also being promptly published in each issue of the quarterly journal *Terrestrial Magnetism and Atmospheric Electricity*. Thus the magnetic declinations observed on the *Carnegie* up to her return, last December, have already appeared in print.

The exclusion of possible disturbing effects on the instruments has been carried out quite rigidly. The construction of the observatories is such that it is not possible for a sailor, for example, to bring anything nearer to the mounts of the instruments than eight to ten feet, and the observers are required to state on the observation-forms whether they have removed from their persons all iron or steel articles. The entire personnel is composed of twenty-one men, five usually in the scientific party, and sixteen in the crew, including the watch officers.

This interesting vessel travels at an average rate of about 150 miles a day, from port to port, crisscrossing back and forth in all the oceans. While she carries nearly 13,000 square feet of plain sail, sufficient, with a fair wind, to cover 300 miles a day, and while she has at times, in fact, approximated this speed, no attempt is

XUM

made to go beyond 150 or 200 miles, as this is the desired average distance apart for our magnetic observations at sea.

Daily, even under conditions of sea and weather that before the introduction of our appliances and methods appeared prohibitive of the requisite accuracy, are the zealous observers busy with measuring and promptly computing the magnetic elements. And they likewise make the necessary astronomical observations for the navigation of the ship and the determination of the latitude and longitude of the place of observation. They, furthermore, engage in other useful work, such as meteorological observations, determining the electrical elements of the atmosphere, the amount of atmospheric refraction, etc., so that they are busy from early morn until evening twilight. The evening is devoted to amusement. In this way a passage of six weeks or more between ports passes before one is aware.

The *Carnegie*, while working wholly under private auspices, is recognized universally as carrying out a mission not for the good of any one nation but of all nations. In consequence, the privileges extended to visiting men-of-war are accorded to her and she is the object of courteous attention at every port. Her book of visitors contains the names of many noted personages, among whom was Mark Twain at Bermuda, shortly before his death.

A chart (Fig. 2) shows the cruises thus far accomplished by the *Galilee* (1905-08) and the *Carnegie* (1909-13). The latter has now successfully completed, under the command of W. J. Peters, two cruises: the first of 8,000 miles in the North Atlantic between August, 1909, to February, 1910, in which the ports of call were, St. John's (Newfoundland), Falmouth (England), Funchal (Madeira), and Hamilton (Bermuda); the second, a world-encircling cruise of over 92,600 miles, in the Atlantic, Indian, and Pacific Oceans, starting at Brooklyn in June, 1910, and including the ports San Juan (Porto Rico), Para (at the mouth of the Amazon), Rio de Janeiro, Buenos Aires, Capetown, Colombo (Ceylon), Batavia, Manila, Suva (Fiji), Tahiti, Coronel (Chile), Stanley Harbor (Falkland Islands), St. Helena, Bahia (Brazil), St. Helena (second time), Falmouth (England), and ending at Brooklyn last December. The total mileage of the two vessels up to date is about 160,600.

You will observe that the tracks interlace and frequently cross, this being done intentionally in order to supply, by repeating observations at the points of intersection, both desired control and

the necessary data for determining the amount of change in the magnetic elements since an earlier cruise. For similar reasons, our cruises have been arranged so as to intersect the routes of other vessels on which a certain amount of magnetic work had previously been done.

The three magnetic elements, declination, dip and intensity, have been determined along the various tracks at points averaging 150 to 200 miles apart. With our special appliances and with the methods of observing employed, it has been possible to achieve an accuracy in magnetic observations on a moving vessel not hitherto attained. In fact, under fair conditions of sea and weather, and devoting the same amount of time for the ocean work that it is customary to spend in land work, we have demonstrated that the absolute accuracy of the ocean work approaches closely that of the land work in which fixed mounts for the instruments can be had.

The errors in the magnetic declination-charts reached 6° in the Indian Ocean. The errors in the dip-charts amounted frequently to 5° or 6°, and in the horizontal intensity to about 5 per cent. of the value. Often the errors are of the same sign for long stretches; and from the values found at the points of intersection of our tracks, it has been shown that the chart errors are caused, to a large extent, by erroneous secular changes assumed in referring past observations to a later date.

But we must not forget that, although the oceans cover about seven-tenths of the surface of our globe, it is equally important to science, as well as to the geographer and surveyor, to trace the folds of our "gossamer garment, woven of lines of magnetic force" over the land areas as well. This is a matter of no little interest also to the geologist, for many interesting correlations are found between irregularities in the distribution of the earth's magnetism over the land and geologic formations.

Except when approaching land, or in shallow water, the isomagnetic lines over the oceans appear to run smoother than over land. Largely on this account, now that we have a vessel specially suited and have our appliances perfected by an experience of nine years, it is found easier and more expeditious as well, to make an ocean magnetic survey than a land magnetic survey. In the latter case more observations must be made, *i. e.,* at shorter distances apart, in order to eliminate, as far as possible, the purely local effects due perhaps to iron-bearing rocks nearby which affect the magnetic needle. Then again, the transportation over more or less un-

XUM

traveled countries presents problems not, in general, inherent in the ocean work. However, before passing to the land expeditions, let us turn aside a moment and consider another phase of magnetic work.

The Sun, a Great Magnet

While on an inspection trip during 1911, to join the *Carnegie* at Colombo, Ceylon, and to visit, en route, various land parties and magnetic observatories, advantage was taken of an enforced three-weeks' stay at Suva, Fiji, to observe the total solar eclipse on April 28, 1911. After various vicissitudes, too long to narrate, with the

Fig. 5—L. A. Bauer's eclipse party and station on Manua Island, Samoa, April 28, 1911.

courteous aid of Acting Governor Schultz (now Governor) of German Samoa, and of Commander Crose (then Governor of American Samoa), I finally reached, on April 26, two days before the day of the eclipse, Manua Island, one of the Samoan group belonging to our country (Fig. 5). This island, being off from the regular line of travel, is rarely visited by the tourist. I, with my effects, was transported there from Pago Pago (Tutuila) on the United States gunboat, *Annapolis,* kindly put at my disposal by Governor Crose, who also gave me the desired scientific assistance by assigning to the proposed work various naval officers, to all of whom I am no little indebted for whatever success was achieved.

Fortunately, through the skill of an experienced pilot furnished by Governor Crose, all instrumental effects were safely landed through the breakers. Not enough can be said of the hospitality shown and assistance rendered by the Samoan inhabitants of the island. Queen Vaitupu quartered the observing party in her own house and the Samoan chiefs provided for our entertainment.

Though the day before the eclipse was cloudy and showery, the following day was clear and sunny. We alone of all the eclipse parties, as it afterwards turned out, were thus favored.[1]

Repeated observation has now clearly demonstrated that the soft, pearly light seen surrounding the sun when the moon blots out for the moment the sun's burning glare, known as the solar corona, passes through a cycle of changes in entire rhythm with the sun's activity as displayed by sunspots and solar eruptions. Furthermore, it has been repeatedly observed by various investigators, that the coronal streamers appear to curve towards the sun's poles as do the lines of force of a magnetized sphere. Hence, the inference is close at hand that, if the sun, like the earth, were a magnet, then perhaps the solar corona is a phenomenon similar to our polar lights. Within a year, it has been definitely proven by Professor Hale, Director of the Mount Wilson Solar Observatory of the Carnegie Institution of Washington, that the sun is indeed surrounded by a magnetic field with lines of force very similar to those enveloping our own planet.

Thus the earth is not alone clothed in "a gossamer garment, woven of lines of magnetic force." If the sun, in spite of its intense heat, at which no magnetism, as exhibited by our permanent magnets, could exist, nevertheless possesses a magnetic field, what is the agency essential for the production of a magnetic field? The query has been raised "whether every large rotating mass may not be a magnet." If the answer be affirmative, picture to yourselves orbs innumerable spinning through space surrounded by pulsating, vibrating fields of force, ever interacting and responding to each other's external influences. Daily are registered at our magnetic observatories messages from without which perhaps some day we may be able to interpret.

[1] There was shown, on the screen, a reproduction, from a sketch, of this eclipse as seen at sea by Captain Holford of the steamer *Tofua*, and, alongside, a sketch drawn by the late Professor Langley of the eclipse of 1878. The juxtaposition of the two sketches exhibited a remarkable similarity between the two. The interval between the two eclipses was thirty-three years, or three times the sun-spot cycle. The years 1878 and 1911 were years of minimum sun-spot activity.

XUM

Land Expeditions

The dots, about 2,500 in number (Fig. 2) show where the observers of the Department have determined the magnetic elements on land. It will be seen that the land observations cover nearly all regions of the globe. The aim is to include in our survey only those countries where no organization exists prepared to undertake such work. The surveys in progress under other auspices are not shown on this map. It is gratifying to say that these surveys are being conducted in cooperation with our design of a general magnetic survey of the globe. The magnetic standards used by the various foreign organizations are compared from time to time with the standards of the Carnegie Institution, thus making possible a strict correlation of all magnetic data obtained the world over.

As an indication of the general interest evinced, the following resolution may be cited, which was passed at the St. Petersburg meeting of the International Association of Academies held in May, 1913:

"The Committee, in view of the work of making a magnetic survey of the globe, particularly on the oceans, undertaken by the Carnegie Institution of Washington, resolves that it is of the highest importance that similar work be completed as soon as possible, in those countries where no surveys exist or where they have been made at epochs relatively distant from those of the Carnegie Institution of Washington."

It is not possible to individualize here the remarkable work accomplished by our observers. Suffice it to say that many of the expeditions, frequently embracing comparatively unexplored regions, have been attended with more or less danger, and have presented special difficulties which had to be surmounted. They represent geographic achievements as well as scientific work successfully accomplished under trying conditions, *e. g.*, the crossing of the Sahara from Algiers to Timbuktu and thence to Lagos, Nigeria; the complete crossing of China from east to west, of Australia from south to north, of South America from east to west and north to south; extensive canoe expeditions in British North America, etc.

Summary

In a summary or general statement of what has been accomplished from 1905 to January 1, 1914, in execution of the design of the general magnetic survey of the globe, now about two-thirds completed, we may recite the following facts:

Mileage covered on the cruises of the *Galilee* (1905-08) and the *Carnegie* (1909-13), the magnetic elements having been determined completely, on an average, about every 175 miles.		160,600
Mileage covered by land expeditions in the establishment of about 2,500 stations in all parts of the earth, at an average distance apart of 75 miles, roughly		800,000
Total mileage traveled by ocean and land expeditions, in round numbers (or forty times the circumference of the earth)		1,000,000
Number of land expeditions sent out	38	
Number of Arctic expeditions cooperated with	4	
Number of countries in which magnetic work was done:		
Africa	25	
Asia	9	
Australasia	7	
Europe	5	
North America	13	
South America	12	
Island Groups, Atlantic Ocean	8	
Island Groups, Pacific Ocean	12	
Island Groups, Indian Ocean	3	
Total	94	
Number of articles and publications by members of the Department, about		125

Construction Work:

A non-magnetic vessel built (the first of its kind).

A building, containing forty-four rooms, erected to provide the necessary facilities for the research work at Washington (Fig. 6).

Seven new instruments devised and constructed, especially designed for ocean and land magnetic work.

While the figures given show that, thanks to the means provided by the Trustees of the Carnegie Institution of Washington, and the zeal of the observers, a large amount of work has been accomplished not of interest alone to the investigator of the earth's magnetism but to the geographer as well, the record we are proudest of is the fact that the entire work has been done thus far without loss of life. The *Carnegie* returned to Brooklyn last December after a successful cruise of 3½ years, during which she covered 92,600 miles in the Atlantic, Indian, and Pacific Oceans, without loss of sail, or spar, or human life. Surely a proud record for the Commander. And as to the land observers, if you will allow me to quote from a recent report:

"It is impossible to refer to the observers individually in calling attention to the devotion, zeal, enthusiasm, and ability displayed in the successful accomplishment of duties well performed, at times under most adverse circum-

XUM

stances, in strange countries, amid strange people with strange customs and speaking a strange language; often over infrequently traversed roads and even at times in regions either rarely or never before, as far as known, reached by white man; pursuing the work faithfully, even when revolution was rife in the countries visited and travel was attended with many dangers; following steadfastly in the direction of their goal at no little sacrifice of personal comfort and even sometimes at the risk of life and limb. They have carried on their work in nearly all the regions of the globe from latitude 78° North (Greenland) to 43½° South (New Zealand)".

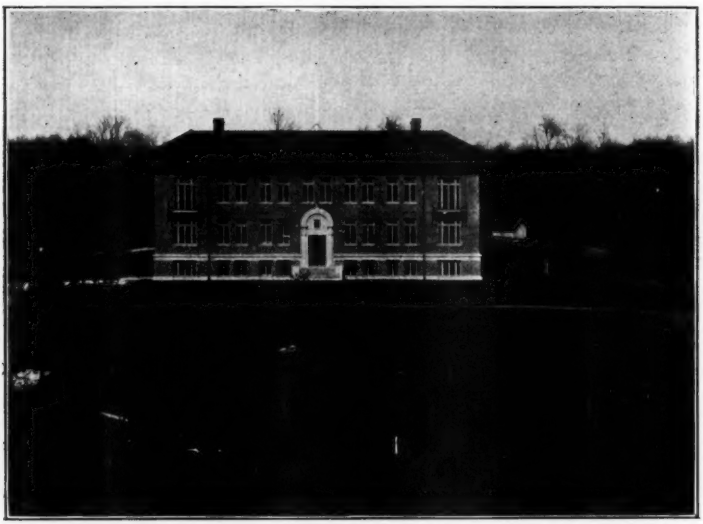


FIG. 6—Newly erected Research Building for the Department of Terrestrial Magnetism at Washington, D. C.

CONCLUDING REMARKS: THE CAUSE OF THE EARTH'S MAGNETISM

Possibly by this time, if not before, you may have said to yourselves: "Granted that the compass needle points north and south because the earth itself is a magnet, what, in turn, causes the earth's magnetism, why are the magnetic poles not only not situated at the geographical poles, but not even diametrically opposite one another, or why, instead of wandering to and fro with the lapse of time, do not the magnetic poles remain fixed in position?" Lest any of these questions should cause you sleepless nights, let me say that, for the present at least, it would appear the better policy to confess ignorance. We may also take comfort in the fact that if the student of the earth's magnetism has not yet discovered

the true cause of his science, neither has the investigator of magnetism, in general, been able as yet to answer the question: "what is a magnet?"

The most famous astronomer of his time, Simon Newcomb, one day entered the office of the associate editor of the *Standard Dictionary*, expressing his dissatisfaction with the tentative definitions for the words "magnet" and "magnetism," as based, in the absence of authoritative knowledge of the causes, simply upon the properties manifested. He was promptly requested to try his own hand. After writing and erasing alternately for an hour or more, he finally, with a hearty laugh, submitted the following pair of definitions: "MAGNET, a body capable of exerting magnetic force." "MAGNETIC FORCE, the force exerted by a magnet." Equivalent definitions will be found in Ambrose Bierce's "Devil's Dictionary" and, in explanation, the author cynically remarks that they were "condensed from the works of 1,000 eminent scientists, who have illuminated the subject with a great white light, to the inexpressible advancement of human knowledge."

But after all, it would seem that it is not so much the Why and Wherefore as the Therefore by which human progress is most advanced. Man, as the astronomer Littrow jokingly remarked, is "das Ursachen-thier," who is ever incited and stimulated by his inquisitiveness as to the *cause* of things. Though he may never determine the "Endursachen," or ultimate causes, his inquiries lead him to acquire a vast amount of data with the aid of which he at least finds out the laws governing the phenomena under investigation.

The accumulation of data must at present be the chief aim of the student of the earth's magnetism. Perhaps no other subject can furnish more instances that, while theories as to the why and wherefore, though propounded by the most enlightened of the age, are short-lived, the facts accumulated by observation and experience remain as permanent acquisitions to the storehouse of human knowledge. In the words of Robert Louis Stevenson, whose island home we visited:

> "To travel hopefully is better than to arrive,
> And the true success is labor."

XUM

CUZCO AND APURIMAC

A REPORT ON THE COMMERCIAL AND INDUSTRIAL OUTLOOK OF SOUTH CENTRAL PERU

By OSGOOD HARDY, M.A.*

The object of this report is to give as much information as possible about the portion of south central Peru represented by the Departments of Cuzco and Apurimac, from the standpoint of their commercial and industrial possibilities. The natural resources and their uses are considered first, followed by a discussion of present conditions and possible relations with the outside world. Two months were spent in the Cuzco basin. Three months were spent in making a circuit from Cuzco *via* Abancay, across the Apurimac at Pasaje, over the cordillera to the Urubamba River at Santa Ana, up the river to the city of Urubamba, and then back again to Cuzco. This afforded an opportunity to see conditions at altitudes varying from 4,000 to 17,000 feet above sea level, giving an acquaintance with the tropical, temperate and frigid zones of Peru (Fig. 1).

Although Peru is a country of great mineral wealth, mining is at present of little importance in the territory under discussion. For a number of years after the Revolution (1821-24), the Portuguese operated some silver and copper mines near Vilcabamba, but these have long since been discontinued. Coal and iron deposits seem to be nil, although a small vein of the former may be seen near San Sebastian in the Cuzco basin. A small excavation was made by the Southern Railroad of Peru, but it was found unprofitable, and at present all the coal for this region has to be shipped from Mollendo. At Juliaca some rumors were heard about the Ferrobamba copper mines. Although these were not then active, it was thought that when communications were opened up, they would become very valuable. Later, in Cuzco, an American engineer in the employ of the company, expressed a similar opinion in regard to its future. The offices of the Inca Mining Company at Tirapata are passed on the way up from Mollendo. Although it has been active in the past, it was not doing anything in 1912. These are the only evidences in the two departments of active mining in recent years. One is constantly hearing of rich prospects. For instance, at Paltaybamba, a

* Mr. Hardy was Assistant on the Peruvian Expedition of 1912 under the auspices of Yale University and the National Geographic Society.

sugar plantation on the Vilcabamba River, one half day's journey from where the river empties into the Urubamba, the proprietor will gladly show the visitor silver and copper ore which "needs only capital to produce rich dividends."

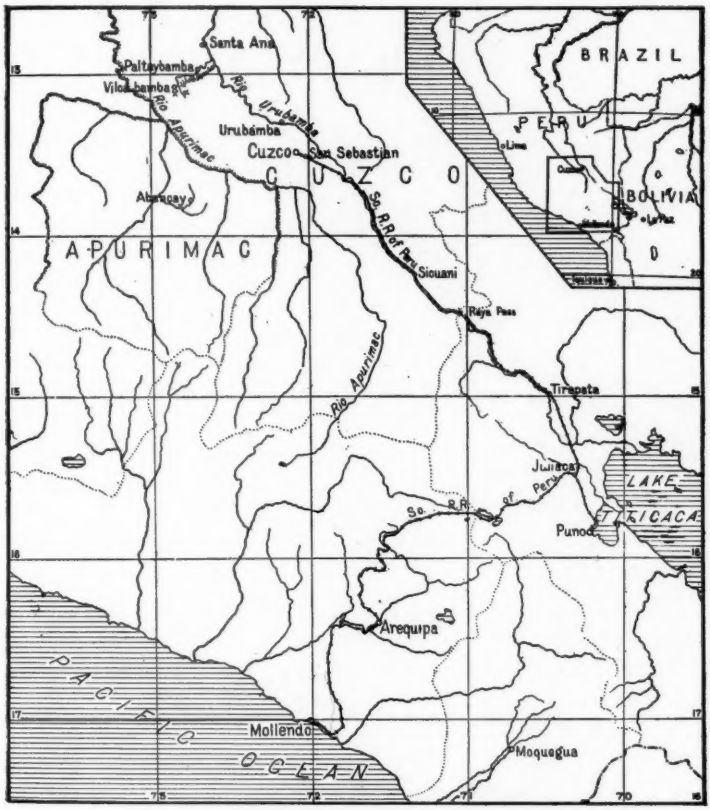


FIG. 1—Sketch Map of South Central Peru.

In considering the vegetable products it is well to have clearly in mind the topography of the regions visited. For the most part this is a high *puna* country, a rolling plateau covered with thick clumps of *ichu* grass which is useful as fodder and thatch. The plateau is broken by numerous deep and steep-sided river valleys. The only wild vegetation is the grass on the highlands, and under-

brush on the sides that becomes denser on the lower slopes until, in the valley bottoms, where there is rain enough, it becomes a dense tropical jungle. No timber growth, however, is especially valuable. On the plateaus there are a few *molle* or pepper trees similar to

Fig. 2—Cuzco. Recoleta ruins. Seats cut in rock. Cuzco city in distance.

those in California, but much smaller than those of that state. Eucalyptus is a success wherever cultivated. Although crooked and gnarled, the tough and hard timber of the valleys is used to advantage by the Indians in making their agricultural implements.

The lack of any tree growth around Cuzco has given rise to a considerable trade in wood taken from the valleys to the city, where it is used as fuel for cooking purposes (Fig. 2). The Urubamba valley is the chief source for this trade. A large number of the river valleys have but a scanty growth, and where the Apurimac was crossed at Pasaje, nothing but extensive stretches of cactus and thornbush were encountered. The scarcity of timber may be best illustrated by the fact that the railroad ties are shipped from the United States, and that the telegraph poles are made from iron, to resist alike the ravages of man and insect. Some of the hard woods of the tropical valleys are handsome and might be used for cabinet purposes were they not so difficult of access.

FIG. 3—Grinding maize at Colpani. A native hut.

The cultivated vegetable resources may be divided into three classes according to altitude. Above 12,000 feet, the only plant grown is the potato, which is a native of this region and Bolivia. It is of good quality although small, but is seldom eaten until after it is subjected to a drying and freezing treatment which reduces the weight considerably, makes the tuber more wholesome according to report, and certainly adds an insipid quality that renders it highly unpalatable to the average foreigner. As the potato belt extends from 13,500 feet down only to 8,000 feet, there is a large trade in carrying potatoes to the valleys below. From 12,000 to 10,000 feet, wheat, barley and oats are raised extensively, while from

10,000 to 8,000 feet maize is added to the list of cereals (Fig. 3). Around Cuzco, grain is the chief article grown, and the upper Urubamba valley is known as the bread region of the country. Below this limit, the Apurimac and Urubamba valleys are lined with cane and coca plantations, the former producing sugar, *chicha* (a native drink corresponding to our cider), and white rum, while the coca plant provides a leaf that the natives are constantly chewing (Fig. 4). The tropical fruits, oranges, limes, bananas, alligator pears, etc., all grow here and are of excellent quality. Few of them are shipped excepting from the valleys to such centers as Cuzco and Abancay, the markets for the fruits of this region.

This part of Peru is not very well supplied with wild animal life. The vicuña, the smallest of the camel tribe, a cousin of the llama, alapaca, and guanaco, and like the last in that it has never yet been tamed, is occasionally seen. Blankets made from its wool, and costing from $25 up, are in fair supply, which seems to indicate that its destruction goes on in spite of the law prohibiting it. In the mountains a small rodent called the viscacha lives among the rocks, while mice, guinea pigs and foxes are found in the lower *punas*. Bears and jaguars are said to make their appearance at times in the wilder portions of the country. Deer are quite plentiful in the cordillera between the Apurimac and Urubamba rivers and supply very good venison. Birds are numerous in all sections. In the mountains, the condor is almost constantly in sight along with falcons, eagles, Andean gulls, black ibis, egrets and crows. Around the wetter parts of the *punas* there is a great variety of ducks, geese and flamingoes, with plover and partridges in the drier parts. In the valleys, parrots, humming-birds, thrushes, and countless other birds are always present. The rivers are said to be filled with fish but no evidence of this was obtained. The fish consumed in Cuzco come from Mollendo or Lake Titicaca.

There are, however, a large number of domestic animals. Around Cuzco the first to be mentioned is, of course, the llama, useful as a beast of burden and for its wool. It is used chiefly above 10,000 feet and almost exclusively by the Indians. Its value as a means of transport is limited by the fact that it can carry only loads weighing less than 100 pounds. After it becomes too old to work the Indians kill it, using the flesh to make a kind of jerked meat. The ordinary price of a llama is about $5. Sheep are grown in the puna region, their value depending chiefly on the length of time since they were last sheared. As a result it is often quite difficult to purchase them and prices vary from seventy cents to several dollars.

They are largely used by the natives for food, and in almost every pack train the carcass of a sheep may be seen. Goats are raised exclusively in the rocky sections and are valued largely for their wool. Cattle raising is carried on to some extent between 8,000 feet and 13,000 feet, principally for hides, although there is a small

FIG. 4—Santa Ana. Near view of coca plant.

market for beef in Cuzco. The demand for dairy products is strong and at present far surpasses the supply. The natives do not understand the use of cream, but use a great deal of milk with their coffee. In the Cuzco basin there are a number of fine oxen, used

XUM

for agricultural purposes. Horses are of course abundant. Most of the owners of the haciendas have very good mounts, but the average Indian's horse, when he has any, is a rather poor specimen. In fact, when the writer landed in New York on his return, the horses there seemed so large that it was some time before he could become accustomed to their size. The great mainstay of the region for transportation purposes is the mule, smaller than the American mule, but with a better disposition, and with marvelous ability in mountain climbing. A good mule is worth from $50 to $100, while $150 is not an uncommon price for an exceptionally good one (Fig. 5). Burros are largely used by the Indians, but are not valuable, as they can carry only small loads. All these animals have the idiosyncrasy of thinking they are roped the moment they feel the

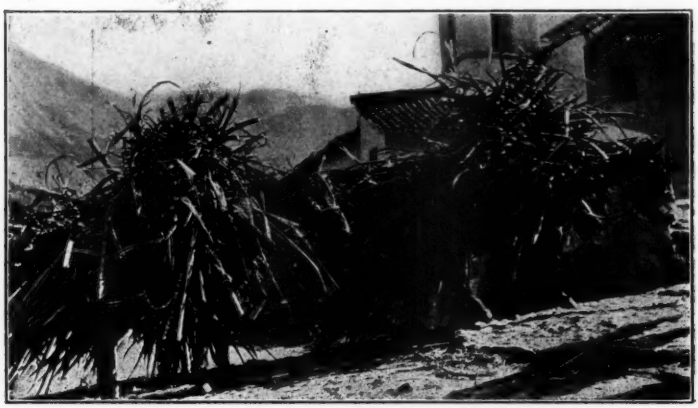


FIG. 5—Huadquiña. Mules carrying cane.

line fall across their necks, and will invariably stop without giving the rope a trial as would an American beast. In the valleys they are greatly troubled by the *murcielago*, a vampire bat which attacks them at night and sucks their blood. In large measure these can be kept off by the use of blankets. It was further observed that the animals whose backs were in good condition were generally unmolested. The natives seem to take no precautions against these pests. At Pasaje, all the animals had been killed off, while in the Urubamba valley, the majority seemed to be in a weakened condition.

These are the natural resources of this part of Peru. It remains, then, to consider its relation with the outside world. Since the

building of the Southern Railroad, communication with Cuzco has been fairly easy. The mail service is good as far as first-class matter goes, but all packages should be sent by registered mail. The city of Cuzco itself has a small telephone system, and has two outside telegraph connections, the government line extending to Lima, and the railroad line connecting with Mollendo *via* Arequipa. By these lines, cables messages may be sent to all parts of the world. Mollendo, the port of entry for this region, is served by a number of steamship lines, the most important being the Royal Mail, the Pacific Steam Navigation Co. and the Peruvian, Chilean, and Kosmos lines. These lines make weekly and fortnightly calls, an average of over thirty vessels entering the port every month. Freight is handled also by a number of private lines such as that of W. R. Grace & Co. At the present time it takes six and a half days from Panama to Callao, and two days from there to Mollendo. From Mollendo to Cuzco is a matter of three or four days according as one takes the weekly express or the twice-a-week local. All steam communication ends at Cuzco, and from that point one has to employ the mule, burro, llama, or Indian, the mule pack train being the common method of transportation. The average price for the mule pack train was quoted as about a half cent a pound of freight per day, covering a distance of from fifteen to twenty-four miles, depending on the gradient of the trail. There is only one road in this section, the old stage road from Cuzco to Sicuani. With the coming of the railroad the old stage line went out of business, and with its departure the number of wheeled vehicles has been reduced almost to zero. While the writer was in Cuzco only one was seen.

For the average foreigner the next question relates to the climate. Around Cuzco it is excellent. During June and July it is cold, with ice on the water in the mornings, and snow on the mountains. It grows warmer through August, September and October, but remains without rain during these months. In November the rains begin as daily thunder showers, increasing in duration until in January and February it rains almost continuously, decreasing again through March, April, and May. The same conditions prevail in the greater part of the region, the rains being somewhat later in the lower country, while in the higher portions between the two great rivers the sky is overcast the greater part of September and October, with weekly rains. Along the river valleys the climate is quite trying. It is very hot and sticky, with the ever present fly and mosquito to emphasize the fact. If one enjoys hot weather,

XUM

however, this valley climate is in some places very delightful. To the writer, the climate of the Urubamba valley around Santa Ana seemed particularly pleasant.

In Cuzco there is a great deal of typhoid fever, due to the unsanitary condition of the city. On the higher plateaus, when we were there, smallpox was decimating the population frightfully and little or no effort was made by the government to help stamp it out. Malaria was quite prevalent in the valleys, but did not seem to cause much alarm. These diseases, however, need not affect the foreigner who takes the trouble to be vaccinated for typhoid and smallpox before leaving home for Peru, and uses quinine as a prophylactic while in malarial districts. Dysentery is more dangerous and nearly every one suffers more or less from it. This, however, can be held in check by sufficiently large doses of bismuth subnitrate. The great trouble is that not enough of the drug is used before the disease becomes serious. While there is much disease, the ordinary foreigner may escape by taking necessary precautions. In this region there is no medical aid to be obtained excepting in Cuzco. Dangerous cases have to be taken to Arequipa, where the treatment is poor in comparison with that of our own country. There is a great opening for a competent medical man in this part of Peru.

The next consideration for any one who contemplates starting an industry here is the labor supply. This region suffers from the same trouble that is affecting the rest of Peru. Time and again, as an excuse for the dearth of labor, we were told: "No hay gentes,"—there are no people. Even the Peruvians cannot get a sufficient labor supply to carry out their own projects. The country is, for the most part, divided into haciendas or *fincas* with areas varying from a few hundred acres to those whose owners count their land by the square mile, as in the case of the hacienda Huadquiña which has a frontage of thirty miles on one river and forty on another. The difference between a hacienda and a *finca* is the same that marks the difference between a farm and a plantation in the United States, that is, a difference in location. But there is this distinction that, in the United States, a farm is usually a landed estate in the North, while a plantation is a landed estate in the South. In Peru a *finca* is a landed estate in the uplands, where it is cool, while the hacienda is in the warm valleys of the lowlands. The labor in both cases is performed by Indians who receive their houses, a small portion of land for tillage, and some grazing privileges free of charge. In return they are bound to work for the proprietor when necessary

at wages varying from ten to fifty cents a day. The estates are usually in charge of a *mayor-domo,* the owners preferring the life of the larger cities.

In spite of the high birth rate, from ten to fifteen children being the usual number, the population is not greatly increasing as infant mortality is very high and the diseases mentioned above exact a fearful toll. In addition, the supply of labor is not so great as the total population would seem to indicate, for labor efficiency is low. The Indian has no ambition, perhaps because of the repression of his ancestors in the colonial period, or owing to the effects of constant coca chewing. At any rate, all the Indian wants is barely enough to live on. Higher wages, therefore, offer no inducement to him to

FIG. 6—Huadquiña. Indian Houses.

work harder, but rather less. Further, he has to stop every few weeks to celebrate one of the innumerable feast days. To these must be added other days devoted to sobering up, for no feast is properly celebrated unless a large part of those engaged in it become intoxicated. As the Indian's food is chiefly parched corn, dried mutton, and potatoes, the production of which requires only a minimum of work, it will be seen that there is little inducement for him to work—consequently he does not (Fig. 6).

In every line of work the people are very primitive. The laborer's tools are such as have been in use for centuries. They are the short-handled, broad-bladed hoe, a spade with a knife-like blade three inches wide and a foot long, with handle some ten feet in length,

XUM

and the machete, used chiefly in the valleys in cutting sugar cane and clearing the underbrush. Of these, the hoe is chiefly used, the spade being seen only in connection with potato growing. In the management of the estates we found a variety of conditions. In one, for example, we found a modern hydro-electric plant which did all the work of crushing, and supplied light for a very fine hacienda. The crushers and electric plant were of American manufacture, while the distilling plant was of German make; which was true of every hacienda visited. In contrast to La Estrella, we found at Santa Ana that the water power was applied directly to the crushers, and the still was several hundred years old. In another place, where the most primitive methods were in use, the crushing was done by ox power. In the grain region, conditions are even less modern. The plowing is done mostly with a wooden plow drawn by oxen or by hand. The grain is cut with a sickle, carried to the threshing floor on the backs of Indians or burros, and threshed with curved sticks or by the treading of oxen. There seems to be a better knowledge of irrigation methods, due, no doubt, to the inheritance of the old water systems of the Incas, which were very well laid out.

The sugar plantations are in the larger river valleys near the streams, as frequent irrigation is necessary for the best growth of the sugar cane. In the rainy season, irrigation may be dispensed with, but in the dry season it is extensively carried on. In this industry considerable skill is shown, rotation of crops is practiced, and the cane is planted and cut at such intervals that there is always a supply ready for the crushers. The time necessary for growth varies with the amount of water available and the climate. On the Apurimac, at Auquibamba, it was found that only three cuttings were possible at intervals of three years, three years after planting. At Santa Ana, on the other hand, the first cutting takes place one year from the planting, and goes on annually for ten years before it has to be replanted. The coca industry is said to pay better than the sugar industry where both can be carried on. The leaves (the commercial product) are picked by women from the low shrub, which is planted in long rows for irrigation and much resembles a field of belle-peppers in California. The leaves are then dried for a day, during which they are constantly turned over and over, and then packed in banana leaves ready for shipment.

In the light of these conditions it is doubtful if there is a wide opening for modern agricultural machinery in this section. Although the climate is favorable, the labor supply is lacking. The chief hindrance, however, is the lack of good transportation facilities

from the valleys to the markets, both local and foreign. At the present time, none of the haciendas are working to their full capacity, as the market for sugar and rum is quite well supplied. The only remedy lies in export, but the transportation facilities are anything but favorable. Modern agricultural methods would increase the output, but not the demand. All the goods would have to be transported to Cuzco by mule and from there shipped by rail at very high rates to Mollendo, with high steamship rates. From no standpoint, therefore, is there as yet much inducement for foreign capital to enter this region to start agricultural industries.

With regard to advantages offered to manufacturers it may be said that wool is the only raw material that would be an asset, and this would be more than offset by the poor labor supply, the high cost of transportation, and the fact that the Indian is quite willing to see his wife do the family spinning and weaving. Cotton is manufactured in some parts of Peru, but not in this region. There are several woolen factories in and around Cuzco, but they have not as yet built up a large trade. It is likely that the Indian will not be enticed from his home-made poncho for some time to come. The only growing industries are those of some brewing companies. The German breweries are doing a large business, but the National Company is not as yet very successful. The market for beer is limited by the fact that the Indian still prefers his native *chicha* made from corn in the uplands and from sugar cane juice in the valleys, and the number of Peruvians of the upper class here is relatively small.

For the American manufacturer who wishes to sell goods here, the outlook is slightly better. In 1909 Cuzco was reached by the railroad, which is beginning to bring to the inhabitants some of the comforts and labor-saving devices of civilization. There is at present a constant demand for a few lines such as cotton goods, canned foodstuffs, cheap grades of hardware, paints and oils, patent medicines, toilet preparations, etc. These are the goods that find readiest sale here.

The Departments of Cuzco and Apurimac have a population of 615,000, according to the census of 1896. The vast majority are Indians with simple wants. It is possible that new wants may be created and new methods taught, but it can be only by actual and repeated demonstrations of the advantages offered. In developing these demands the exporter will find that he must grant long term credits; ascertain just what is wanted and supply exactly that; spend much money in developing trade without expecting imme-

XUM

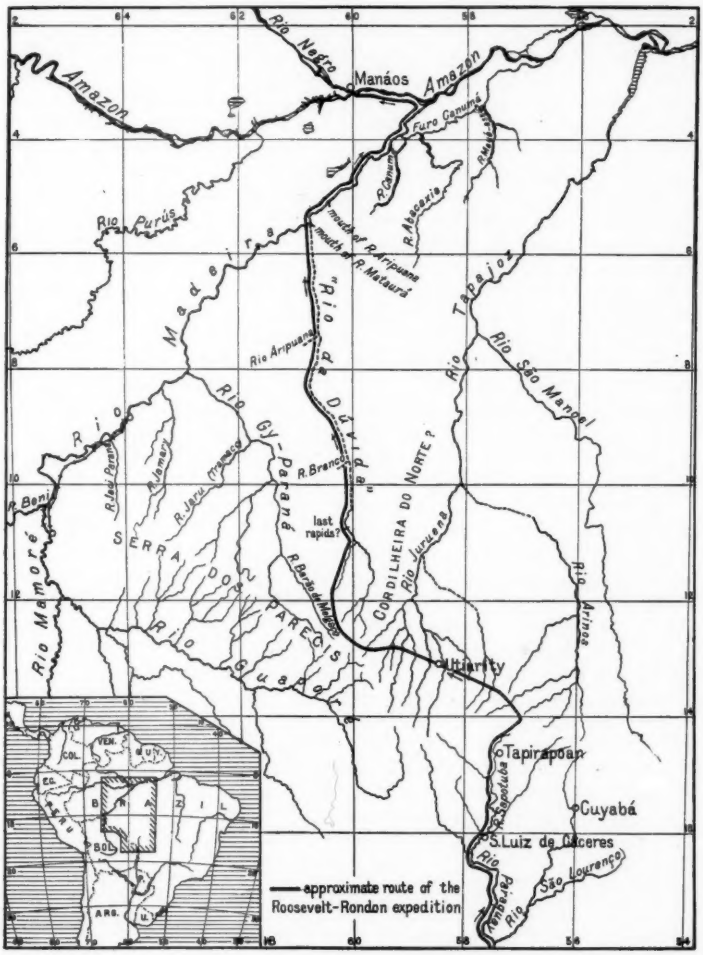
diate returns, and attend very carefully to the details of packing and shipping. Even when these conditions are met, the opportunities for foreign trade are slow in developing. The people are poor, unambitious, and content with their lot. Any campaign of trade here must be primarily one of education.

COL. ROOSEVELT'S EXPLORATION OF A TRIBUTARY OF THE MADEIRA

Col. Roosevelt's lecture before the National Geographic Society of Washington on May 26, as reported in full in the *New York Times* of the following day, affords the first general account of his recent descent of a hitherto unknown tributary of the Madeira. The narrative of his trip across South America which is appearing in *Scribner's Magazine*[1] has, in the last number available, only progressed as far as São Luiz de Cáceres (16° S.) on the upper Paraguay and, therefore, does not include this part of his journey.

Although not intending to undertake original exploration, Col. Roosevelt, prior to his departure for South America, had already decided to return, not by the conventional trip by sea along the west coast but, instead, by crossing the continent from south to north. From Buenos Aires he planned to ascend the Paraná and Paraguay Rivers and cross over into the Amazon basin. On hearing of his plans in Rio de Janeiro, Dr. Lauro Müller, Minister of Foreign Affairs of Brazil, made arrangements to have Col. Roosevelt met at the Brazilian frontier by a colonel of the Brazilian army, who was to accompany him over the divide to the headwaters of the river selected for the descent into the Amazon basin and probably go with him for the whole distance. The selection of the tributary of the Amazon to be followed was determined by a possibility which Dr. Müller pointed out to Col. Roosevelt. Col. Candido Mariano da Silva Rondon, the officer delegated to accompany Col. Roosevelt, had for years been engaged in exploring the ill-known highlands of Matto Grosso. In 1907 he had been sent by the Brazilian government to explore the region on the divide between the headwaters of the Madeira and the Tapajoz and to construct a telegraph line to the rubber settlements on the Madeira. On this occasion he and his assistants surveyed for the first time the Gy-Paraná and the Juruena, the former an important tributary of the Madeira, the latter, of the Tapajoz. A couple of days' march northwestward from a station he established on the divide between the Gy-Paraná and the Juruena, which he named José Bonifacio, he, in 1909, came across the headwaters of a river running northward between

[1] Theodore Roosevelt: A Hunter-Naturalist in the Brazilian Wilderness, *Scribner's Magazine*, Vol. 55, 1914, pp. 407–435, 539–558 and 667–680.



Sketch map showing the general course of the newly discovered tributary of the Madeira and the approximate route of the Roosevelt-Rondon expedition. Scale, 1:12,750,000.

The inset shows the location and extent of the main map.

The drainage of the region between the headwaters of the Paraguay and the upper Madeira is based on the surveys of Col. Rondon's expedition of 1909 (see footnote 2). In the north, only the surveyed portions of the Canumá, Abacaxis and Maué-assú are shown.

XUM

these two river systems.[2] As to where it debouched, he could only guess, although he believed it emptied into the Madeira. As all inferences with regard to its course were mere conjectures he entered it on his sketch maps as the Rio da Dúvida, or the River of Doubt. It was the possibility of following this river to its mouth that Dr. Müller suggested, a proposal which Col. Roosevelt gladly accepted.

The expedition as constituted at the outset of this trip consisted of two parts, the members of Col. Roosevelt's party and the assistants of Col. Rondon. The expedition was officially designated, after its leaders, "Expedição Scientifica Roosevelt-Rondon." The Roosevelt party included: Kermit Roosevelt, Col. Roosevelt's son; George K. Cherrie, ornithologist, and Leo E. Miller, mammalogist, representing the American Museum of Natural History of New York City; Anthony Fiala, best known as commander of the second Ziegler polar expedition of 1903-05, who had charge of the equipment; Father Zahm, late of Notre Dame University, Indiana; Frank Harper, Col. Roosevelt's secretary; and Jacob Sigg, hospital nurse and cook. Col. Rondon's companions included Captain Amilcar de Magalhães; Lieutenants João Lyra, Julio Barbosa, Thomas Reis, Joaquim de Mello and Alcides de Sant' Anna; Dr. Euzebio de Oliveira, assistant geologist of the Serviço Geologico e Mineralogico do Brasil; Frederico Hoehne, botanist; and two assistant taxidermists. Frank Harper went only as far as Tapirapoan (14½° S.), while Father Zahm and Jacob Sigg accompanied the expedition to Utiarity (13° S., see below).[2a] The party which descended the unknown tributary of the Madeira finally consisted only of Col. Roosevelt, Col. Rondon, Kermit Roosevelt, Cherrie, Lieut. Lyra and Dr. Cajazeira, a Brazilian physician, besides sixteen men. Fiala reached the Amazon via the Juruena and the Tapajoz, while Miller, Lieut. de Mello, Dr. de Oliveira and one of the taxidermists descended the Gy-Paraná and the Madeira.[2a]

On January 5, 1914, the expedition had reached São Luiz de Cáceres on the upper Paraguay. From here to the headwaters of the newly explored river the route of the party can not be given with definiteness inasmuch as the two sources cited above leave a gap with regard to this part of the journey. At all events, the party traveled by mule and ox-train in a northerly and then in a northwesterly direction across the highland region which carries the Amazon-Paraná divide, at first following up the Rio Sapotuba, near the head of which the party reached Tapirapoan on January 16. At Utiarity, in 13° S. on the Papagaio, one of the source-streams of the Juruena, the party, it seems, divided

[2] An account of these explorations, by H. Wichmann, based on the original which appeared in the Dec. 24, 1909, Jan. 15 and Feb. 27, 1910, issues of the *Jornal do Commercio*, a daily newspaper of Rio de Janeiro, and entitled "Col Candido Rondon's Expedition im brasilischen Hinterlande" will be found in *Petermanns Mitteilungen*, Vol. 56, I, 1910, pp. 260-261. It is accompanied by a map (Taf. 47) on the scale of 1:7,500,000, which shows, in red, the hydrography of the entire region between the headwaters of the Paraguay and the upper Madeira as resulting from Col. Rondon's surveys, superimposed over the drainage system of the region according to the prevailing conception, shown in black. This striking comparison shows that hardly a river in this extensive tract flows where it was supposed to. The greatest discrepancies relate to the Gy-Paraná and the Jamary. The upper course of the former lies nearly a degree and a half farther west than supposed, a fact to which Col. Roosevelt called attention in his lecture; while the latter in its entirety bears no resemblance whatsoever to its counterpart on existing maps. Instead of rising in 12° S. and 61° W. and flowing northwest, it rises in 11° S. and 64° W. and flows north. On the accompanying map the drainage of this whole region is based on Col. Rondon's surveys.

[2a] Information kindly furnished by Dr. Frank M. Chapman, of the American Museum of Natural History.

into the three groups which were each to reach the Amazon by a different route. The Roosevelt-Rondon party in due course came upon the headwaters of the "Rio da Dúvida." On February 27(?), in 12°1′ S. and 60°18′ W., they embarked on this river, which was to carry them northward into the Madeira.

The general course of this hitherto unknown affluent of the Madeira is given as follows (allowance is made for the discrepancies occurring in the newspaper version of Col. Roosevelt's lecture in Washington): It rises in the highland of western Matto Grosso just north of 13° S. and between 59° and 60° W. at an elevation about 1,000 feet above its mouth (at its confluence the Madeira is about 85 feet above sea level). In its upper course it flows first west and then south, and finally north[3]—a mountainous, timber-choked brook. It is not navigable above the point where the party embarked, which is about 180 miles downstream from its source. From here it flows north for its entire length between the 60th and 61st meridians, approaching the latter most closely in 8°15′ S. It empties into the Madeira in 5°30′ S. From about 11°45′ S. to 10°45′ the river is an almost unbroken series of rapids. Two are designated by name: the first encountered were at Navarite in 11°44′ S.; those met with in 11°12′ S. were named Peishan Rapids. Below the last rapids (10°45′?) the river flows smoothly and has considerable volume. At the junction with the so-called upper Aripuana a volume of 4,500 cubic meters (159,000 cubic feet) per second was measured. This would be more than the mean annual discharge of the Hoang-ho or the Indus and more than three times that of the Rhine.[4] The following tributaries entered the main stream: in 11°23′, the Rio Kermit from the left; in 11°22′, the Marcian Avila from the right; in 11°18′, the Taunay from the left; in 10°58′, the Cardoza from the right; in 9°38′, the Rio Branco from the left; and, finally, from the left, in 7°34′, the Aripuana, which is practically of the same size as the main stream. The estimated length of the river from source to mouth, including sinuosities, is 1,400 to 1,500 kilometers (870 to 930 miles). This would make it somewhat longer than the Rhine and somewhat shorter than the Ohio. The astronomical observations on which these positions are based were made by Lieut. Lyra. Readings were taken at about every half degree or every degree of latitude.

The whole journey from the point of embarkation to the mouth, which was reached about April 30, took about 62 days. During the first four days (Feb. 27-Mar. 4?) the river was slowly descended to 11°45′, and a careful survey of this section of its course was made. The journey from here, where the first rapids were encountered, to 10°45′, where the rapids seem to have ended, consumed 42 days (Mar. 4 to Apr. 15?). Two days later, on April 17(?), the uppermost camp of the rubber men was reached in 10°24′, and eleven days later (Apr. 28?), in 7°15′, the party was met by Lieut. Pyrineus[5] on the steamer which Col. Rondon had previously directed him to take up the Ari-

[3] On the map in *Petermanns Mitteilungen* the headwaters of the "Rio da Dúvida" (referred to in the text as the Rio Doze de Outubro, probably from the date of its discovery in 1909) are represented as on the accompanying map. This does not quite tally with the course as here described.

[4] (Sir) John Murray: On the Total Annual Rainfall on the Land of the Globe, and the Relation of Rainfall to the Annual Discharge of Rivers, *Scott. Geogr. Mag.*, Vol. 3, 1887, pp. 66-77, specifically Table VI, on p. 76.

[5] Probably the same, who, on Col. Rondon's expedition of 1909, explored the Rio Jaru, or Tramaco, a left tributary of the Gy-Paraná. In the account of Col. Roosevelt's lecture his name is spelled "Pyrinez."

XUM

puana on the assumption that this would prove to be the lower course of the river they were to follow. On this steamer the party descended the river to its mouth, and then proceeded down the Madeira and up the Amazon to Manáos, which was reached about May 1.

The trip was attended by no inconsiderable hardships. Of the seven dug-out canoes in which the party started, five were lost in the rapids, and of the three others which were then built, one was wrecked. One of the native paddlers was drowned. Under the strain of the trip another man went mad, shirked all his work, stole his comrades' food, and, on being punished, murdered his superior (Sergeant Peishan, after whom one of the rapids was named), and fled into the wilderness. Col. Roosevelt himself suffered an injury to his leg when his canoe upset. Col. Rondon had a narrow escape from death. While hunting monkeys for food, his dog, which preceded him, was killed by Indians, whose arrows would probably otherwise have struck him, had he not been warned of their presence by the dog's cry. The arduous trip down the rapid-interrupted stretch of the river told heavily on the party's food supply: at the end of this stage of the journey they had used up about three-fourths or four-fifths of their rations, although only about one-sixth of the distance had been covered. Fortunately, at the rubber camp which was reached two days later, some food was procured—sugar-cane, rice and bananas. Conditions were such that everything not absolutely necessary had to be discarded: personal belongings were reduced to the clothes on each man's back, with a spare set of underwear. Even part of the medicine was thrown away. Of the instruments only those needed for the determination of positions were kept.

The geographical results of the trip are of no mean value. In the first place a tributary of the Madeira, hitherto unknown in its entirety, was traced from source to mouth. Col. Roosevelt in his lecture makes it plain that its lower course was known to the rubber men, although it had never been surveyed and was not correctly represented on existing maps. The reference in the lecture to Lieut. Pyrineus's meeting the party coming down, after he had ascended the river known, at its confluence with the Madeira, as the Aripuana, seems to indicate that it is this river which coincides with the lower course of the new river. The Aripuana, however, joins the Madeira in 5°7′ S. according to the standard map of the latter.[6] The mouth of the new river is given by Col. Roosevelt as lying in 5°30′. This position would more closely correspond with the mouth of the Mataurá River, which debouches into the Madeira in 5°28½′. On large-scale maps of the region[7] both the Mataurá and the Aripuana are shown to be rivers of considerable length rising to the south, so that from this point of view both could come into consideration. Identification is further complicated by references in the lecture to a "so-called upper Aripuana" and to a "Castanha branch." With regard to the former the

[6] The Madeira River from its Mouth to the Falls of San Antonio. Surveyed by Comdr. T. O. Selfridge and the officers of the U. S. Ship *Enterprise*, June and July, 1878. [1:100,000.] In 5 sheets. U. S. Hydrographic Office Charts Nos. 893–897. Washington, 1882.

[7] *e. g.*: Mappa Geographico do Estado do Amazonas. Organizado por Ermanno Stradelli de accordo com suas notas e exploracões e baseado nos melhores mappas. 1:2,222,000. V. Porta, Piacenza, Italy, 1901. (The bibliographical list printed on this map indicates a knowledge of the sources which inspires confidence in its reliability.)

Estado do Amazonas: Mappa organisado por Ermanno Stradelli e publicado na administracão do Ex^mo. Senhor Dr. A. Constantino Nery. 1:1,111,000. 1ª Edicão. Aillaud & C^a, 1906. (Wall map).

impression received is that the new river, although the main stream, has locally been interpreted as a branch of the Aripuana and that the name Aripuana is applied both to the tributary entering the new river from the left in 7°34′ and to the new river below this confluence. But this matter as well as all questions concerning the definite location of the new river cannot be settled until the appearance of a map showing its course.

All conjectures as to the hydrography of the region between the Madeira and the Tapajoz, which are based on existing maps, must prove misleading. Although the majority of standard and official maps[8] indicate a comprehensive hydrographic system in this region, they are based, as a competent critic has well observed, "in spite of their copious nomenclature and the inextricable network of their river systems, only on the vaguest data."[9] Col. Rondon's surveys in the Gy-Paraná region, with their sometimes almost complete reversal of previous conceptions as to the drainage system, are an excellent illustration of this. Of all the river courses figuring on the maps between the Madeira and the Tapajoz, only the Canumá, Abacaxis and Mauéassú are based on surveys of any kind,[10] and of these the southernmost (that of the Abacaxis) does not extend much further south than 6° S. The Roosevelt-Rondon expedition has, therefore, made a major contribution towards solving the problem of the hydrography of the region. We now know definitely in the area under discussion the position of the Gy-Paraná in the southwest, of the new river running meridionally through the whole area from south to north, and of the Abacaxis in the north. This makes it highly probable that the new river, as Col. Roosevelt has stated, is the longest affluent of the Madeira.[11] The unexplored area left between the Gy-Paraná and Madeira on the west and the new river on the east can hardly harbor a larger river system, inasmuch as its longest axis measures about 400 miles as against an extension of the new river over 7½° of latitude, or over 500 miles. This does not even take into account the possibility that the tributaries, within this area, of the Gy-Paraná and of the new river, in view of the size of these two river systems, may approach each other so closely (the mean distance between the Gy-Paraná and the new river is 120-150 miles) as not to allow of the development of an inter-

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[8] *e. g.:* Maps of the states of Amazonas and Matto Grosso, on the scale of 1:6,200,000 approximately, constituting Pls. III and XXIII, respectively, of the "Atlas do Imperio do Brazil . . . organisado per Candido Mendes de Almeida," Rio de Janeiro, 1868; with bibliography in the text on pp. 10-11 and 30-32.

Carta do Imperio do Brasil. Organizada pela Commisão da Carta Geral sob a presidencie do General Henrique de Beaurepaire Rohan, com a coadjuvação do Exmo. Sñr. Barão Da Ponte Ribeiro. 1:3,710,220. 1875.

Mappa Geral da Republica dos Estados Unidos do Brasil. Publicado por occasião da Exposição Nacional de 1908 por ordem do Exmo. Sñr. Ministro da Industria, Viação e Obras Publicas, Dr. Miguel Calmon Du Pin e Almeida. 1:5,000,000.

Mappa da Viação Ferrea do Brazil e suas ligações com as rêdes ferreas de Bolivia, Perú, e Republicas do Prata, de accordo com os ultimos documentos e mappas geographicos em 1911. Organisado pelo Engenheiro Emilio Schnoor para a Companhia E. F. Victoria à Minas. 1:5,000,000.

[9] F. Schrader in the bibliographical notice, dated 1894, accompanying Sheet 84 (Amérique du Sud: Flle. N. E., 1:6,000,000) of the "Atlas Universel de Géographie," Hachette et Cie., Paris.

[10] By W. Chandless, in 1868: see his "Notes on the Rivers Maué-assú, Abacaxis, and Canumá," with map, 1:1,000,000, *Journ. Roy. Geogr. Soc.*, Vol. 40, 1870, pp. 419-432.

[11] Previously the Gy-Paraná was so to be considered—a status that only dated, however, from Col. Rondon's expedition of 1909. The Mamoré, Guaporé, and Beni are not tributaries, but source-streams of the Madeira.

XUM

vening stream of any proportion. Between the new river and the Tapajoz this contingency seems more possible, if alone the size of the intervening area be considered, which is about 550 by 180 miles. This includes the drainage area of the Abacaxis; but according to Chandless's account it is highly improbable that this river should take its source as far south as the upland of Matto Grosso, inasmuch as at the mouth of the Arapady, in lat. 6°12′—as far as Chandless ascended—, it was a very small stream with the boughs of the trees on its banks joining overhead.[12] The Canumá, because of its greater volume, might more easily drain the intervening region: indeed it is this river which, on the majority of recent maps, is represented as the most important drainage channel between the Madeira and the Tapajoz, a fact which led one of Col. Roosevelt's critics to suggest that he had descended this river. But even should it, when explored, prove to be longer than the new river (although indicated on these maps as rising as far south as 9° S., it has never been surveyed above the highest point attained by Chandless in 1868, at the junction, in 5°17′, with the Secundury, by which name the main stream is known above this point), it might be argued that the Canumá is not a tributary of the Madeira, inasmuch as it empties only into a *furo*, a backwater, which connects the Madeira with the Amazon. To summarize, therefore: the Roosevelt-Rondon expedition is the first, since Chandless, to give us any definite knowledge as to the hydrography of the area between the Gy-Paraná-Madeira and the Tapajoz, and it seems probable that the newly discovered river is the major drainage artery of that region. Incidentally the expedition has shown that the drainage divide designated "Cordilheira do Norte" on recent maps, which was supposed to extend from the Serra dos Parecis in 60⅓° W. north-northeast between the headwaters of the Gy-Paraná and the Canumá on the one hand and the Tapajoz on the other, and whose existence made other premature critics skeptical as to the route of the party, lies farther east and forms the divide between the headwaters of the new river and the Juruena.

A question of geographical interest connected with the expedition is the location of the lowest rapids on the new river. The report of the Col. Roosevelt's lecture in Washington seems to indicate that these lie in 10°45′ S., although it is not quite clear whether this position refers only to the end of the especially turbulent stretch of the river, which it took forty-two days to descend, or whether it indicates the last of all the rapids. The point is of interest, because, wherever these lowest rapids may lie, they represent a natural boundary. The route of the expedition led through two of the major natural regions of South America, the Brazilian Highlands and the Amazon Lowlands. The Brazilian Highlands, which occupy the whole eastern part of the continent to the east of the Amazon and Paraná-Paraguay lowlands, are an upland area composed of geologically ancient rocks whose varying degree of hardness has given rise to numerous rapids in the rivers which flow over them. On the contrary, the Amazon Lowland is a vast depression whose extremely low gradient (300 ft. in 2,500 miles) makes for the development of quiet, sluggish rivers. The boundary between these two regions is indicated by the final falls and rapids which occur on the southern tributaries of the Amazon where they flow over the margin of the upland into the lowland. On the lower tributaries these rapids lie near their mouths, but, as one proceeds to the west, they lie increasingly farther upstream. Thus, on the Xingú they lie in 3° S.; on the Tocan-

[12] *op. cit.*, p. 423.

tins, in 4°; on the Tapajoz, in 4½°; on the Maué-assú, in 5°; on the Canumá, probably in 6°; while on the Madeira they are in 8⅝° S. If on the new river they should lie in 10¾° S. this would indicate an embayment of considerable magnitude in the Amazon Lowland extending into the Brazilian Highlands at this point.

For all other results of geographical interest we must await the reports of the various members of the expedition. Col. Roosevelt's narrative in *Scribner's Magazine* will probably, as it progresses, furnish additional details, as may his lecture before the Royal Geographical Society in London on June 16. The matter of greatest moment, of course, is a map of the new river: and it is to be hoped that one will soon be published on the basis of Lieut. Lyra's observations. The Serviço Geologico e Mineralogico do Brasil will probably publish Dr. de Oliveira's notes on the geology of the region he traversed—from a geographical standpoint it might be regretted that he was unable to accompany the party which descended the new river—; and botanical results may be forthcoming from Senhor Hoehne. The zoological results of the expedition will doubtless prove to be particularly valuable in view of the fact that the study of faunal life was one of its main objects. Geographically they will probably be of more than usual interest, as, in keeping with Col. Roosevelt's known views on the methodology of natural history, they may be expected to lay stress on the ecological rather than on the taxonomic phase of the subject. The Roosevelt-Rondon expedition has thus, it will be seen, made valuable contributions to our knowledge of a little known section of the earth's surface. Aside from their interest in the expedition as bearing upon their field of work, geographers, above all, can appreciate Col. Roosevelt's feeling of gratification at having been able to participate in original exploration—"a chance," to use his own words, "that from now on, in the present state of the world's geography, can only come to a limited number of men." W. L. G. J.

LOSS OF THE KARLUK AND ESCAPE OF THE EXPEDITION TO WRANGELL ISLAND

The New York Times, on June 1, printed a long despatch from Captain Robert A. Bartlett, Commander of the *Karluk,* dated St. Michael, Alaska, May 31, giving the remarkable particulars of the *Karluk's* drift to the west for 110 days when she was crushed in the ice on January 11, 1914. A large quantity of supplies of all kinds had been placed on the ice, and the entire party reached Wrangell Island over the ice, with food resources for eighty-six days, on Feb. 13. The leadings facts are here condensed from *The Times's* account, with some explanatory comment.

Stefansson left the *Karluk* to hunt on shore on September 20, last year. It was thought that the vessel was frozen in for the winter. She was then about 15 miles north of the mouth of the Colville River. On September 21, a fierce gale from the east came up and, two days later, the ice which held the *Karluk* began to drift westward; and on September 25, Bartlett from the masthead caught a glimpse of Cape Halkett.[1] The vessel was drifting in an ice floe about two miles square. On September 26, the wind veered to the northwest. All leads closed between the ship and shore and the *Karluk* was for three days becalmed within six miles of Tangent Point.[2]

Preparations were begun to leave the ship if necessary. But on September 29, the wind changed to the northeast and the westerly drift was resumed among many grounded icebergs. On October 6, the vessel was twenty-five miles off-shore and drifting rapidly north beyond the 20 fathom line. The next day the *Karluk* was unmistakably north of the continental shelf, probably near the 72nd parallel. On October 11, bottom was found in mud and sand at 6,000 feet, or in oceanic depths.[3] On October 12, starfish and other species of sea life, hitherto unknown in the Arctic, were brought up from depths of about 7,000 feet. Captain Bartlett continues:

"We continued drifting northwest until October 22 when the nearest point should have been Keenan Land about 20 miles south of our position." For several days men with glasses sought land from the crow's nest without finding it.[4]

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[1] Cape Halkett is about sixty statute miles northwest of the mouth of the Colville.

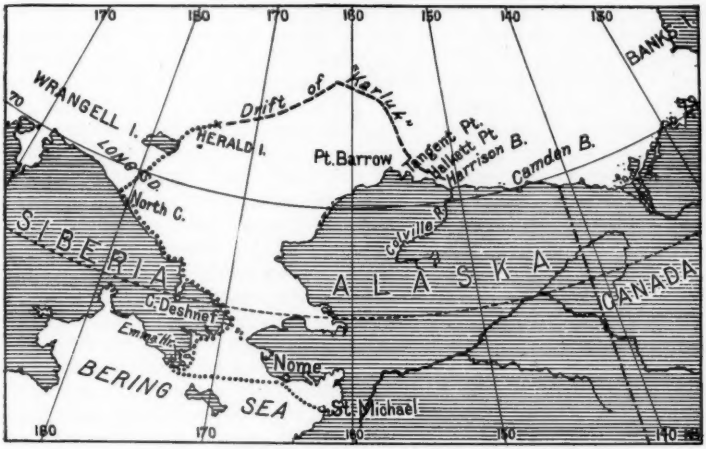
[2] Approximately thirty miles southeast of Point Barrow. The closing of the leads, with more or less shattered ice, would make passage to land very difficult.

[3] In the spring of 1907 the Mikkelsen-Leffingwell Expedition sounded to depths of 620 feet without touching bottom, between 71° and 72° N. and 148° and 150° E. The party was plainly north of the continental shelf but the shortness of the sounding line made it impossible to obtain precise depths (*Bull.*, Vol. 39, 1907, pp. 607-620). These soundings and those of Bartlett, some 4° further west, show that the continental shelf is narrow along this part of Alaska's coast with the strong probability that this condition prevails along the entire coast.

[4] This statement cannot be reconciled with what is conjectured as to the position of Keenan Land, if it really exists. The discrepancy may be due to imperfect telegraphic transmission. Bartlett reports, thus far, an almost invariable drift to the west. He says that, on October 7, his position was 154° 5′ W. But on October 22 "after continued drifting northwest, Keenan Land should have been twenty miles south of our position." Keenan Land is placed on the charts hypothetically in about 146-147° W. Long. The late Marcus Baker said that the position

On November 1, Bartlett reports shallow water again at 100 fathoms. On November 5 he placed on the ice 250 sacks of coal, 100 cases of biscuit and other articles that would be needed after leaving the ship. The party shot their first bear on November 10. Next day the sun disappeared, the water was calm but the prevailing easterly winds kept the *Karluk* steadily moving westward. No current was observed and the ice movements seemed to be influenced only by winds. In his opinion, the prevailing winter winds in that region are from northeast to east. He continues:

"The theory of drifting across the Pole is questionable. Our drift carried the ship to the point where the *Jeannette* began her drift. The *Jeannette*, if not lost, probably would have taken the course of the *Fram*. It is possible that there is adjoining land in an unexplored region."[5]



Drift of the *Karluk* and Captain Bartlett's route.

Bartlett found much animal life in lat. 73°, long. 162° E. approximately. This was the most northern point reached. The date was November 15. Soundings here showed 288 feet. Later in the month the Eskimos caught five white foxes and the dredge brought up eleven species of animal life. On November 24, twilight was still strong enough to permit reading the figures on the transit without the aid of a lantern. The drift continued south and southwest until December 15, when more easterly winds took the ship west-

of Captain Keenan's ship, when he says he saw land, was between Harrison and Camden Bays. Captain Keenan reported that he saw this land in the seventies when in command of the whaling bark *Stamboul*. Land, he said, was distinctly seen by him to the north, and all the men of the crew saw it; but as he was not on a voyage of discovery and no whales were in sight he was obliged to go south in search of them (*Bull.*, Vol. 39, 1907, p. 227).

[5] It may be said, however, that one of the buoys set adrift by Bryant and Melville, to the north of northwest Alaska, was picked up on the north coast of Iceland. Its most probable route was conjectured to be northward across the polar area till it got into the East Greenland south-flowing current which carried it to Iceland.

XUM

ward. On New Year's Eve, 1913, the *Karluk* was sixty miles north by east of Herald Island.

Great ice pressure was observed on January 2. At 3 A. M., on January 10, the men were awakened by a sharp report like that of a gun, and the ship was quivering. The ice had opened from the stem of the vessel in a westerly direction for about 300 feet where the crack closed. At 7.30 P. M. the wind increased to a gale with blinding snow, a corner of the ice sheet struck the ship abreast of the engine room, breaking some of her timber planks, and water began to pour into the engine room. Pemmican, milk, clothing, ammunition, arms, oil, etc., sewn in canvas, were immediately placed on the ice. In spite of the darkness, the men did as much in an hour as they would ordinarily in six hours. Ten thousand pounds of supplies were hauled on sledges to the solid ice pan, one hundred yards away, where a house made of boxes and covered with sails and other articles had been previously placed. An Eskimo woman with her baby was sent to the house to make a fire in the stove and prepare for the arrival of the men. Practically everything could have been saved; but as pemmican, biscuit, tea and milk were sufficient for rations the delicacies were left on the ship.

At 10.45 P. M. there were eleven feet of water in the engine room. By midnight, all supplies had been placed on solid ice. At that time Bartlett sent the men to the shelter house but remained himself on the ship until she sank, on Jan. 11, at 4.30 P. M. in 38 fathoms of water. A snow house was also built beside the boxhouse. All mattresses had been saved, there was a stove in each house, plenty of coal and good food was regularly provided. This place was called Camp Shipwreck. It was decided, as soon as the sun returned, to begin carrying the supplies to land. About 60 miles away, south by west, there appeared to be land which the men thought was Wrangell Island. Mate Anderson, second mate Barker and two sailors were sent ahead on Jan. 20 with three months' supplies to look for game and make a trail to facilitate the removal of the supplies towards shore. Everybody was kept busy making skin clothes. Mamen (the assistant geographer), who, with Eskimos, 20 dogs and three sledges, was sent on to support mates Anderson and Barker, returned in three days and said they had accompanied the mates to within three miles of land. On January 31, it proved to be Herald Island and could not be reached on account of open water. Wrangell Island, thirty-eight miles from Herald Island, was not sighted.

Early in February, Mamen, Dr. A. Forbes Mackay, James Murray, the oceanographer, and Henri Beauchat, the anthropologist, set out for land, hauling sledges and following the trail of the supporting party. Supplies were also advanced along the trail. The whole party reached Wrangell Island[6] on

[6] For over a century before Wrangell Island was discovered it was reported to exist on the strength of Chukchee reports. Wrangell, the famous explorer of north Siberian waters, vainly looked for it in 1824. Nordenskiöld did not see it when he made the northeast passage. It was at last discovered by an American whaler, Thomas Long, who sailed along its south coast, August 14-16, 1867, discovering its southeastern cape and its western extremity. Other whalers also saw it. The great geographer Petermann, who believed that Greenland was a continent crossing the Pole and probably approaching Siberia, advanced the idea that Wrangell Island was the extremity of Greenland towards Asia. The theory of a continent, however, was exploded by Commander De Long, on the Jeanette Expedition, when he entered the pack ice near Herald Island expecting to reach and winter at Wrangell Island. His vessel, however, never escaped the pack but drifted almost steadily westward, passing to the north and in sight of Wrangell Island which thus shrank to the dimensions of a small island.

Feb. 13, landing on an ice spit. Bartlett's party were the first to set foot on this land. Plenty of driftwood was found for fuel. The party then had eighty-six days provisions for every person and three men were sent back to Camp Shipwreck for additional supplies.

Bartlett left Wrangell Island on Feb. 18 for the Siberian shore, one hundred miles away, with Perry and Eskimos, a sledge and seven dogs. His purpose was to secure means of sending relief to his party. He was much delayed in crossing Long Sound (named after Thomas Long) by heavy gales and moving ice. Three of his dogs were lost on the way. He was kindly treated by the natives along the Siberian coast to Cape Deshnef, where he met Baron Kleist, who invited the men to his house at Emma Harbor, Bering Sea, where the chances were best that they would meet a whaler. Emma Harbor was reached in the middle of May, when Captain Petersen of the whaler *Herman* relinquished his whaling and trading enterprise and started with Bartlett and his men for the American coast. Ice prevented them from landing at Nome and they therefore went on to St. Michael. Bartlett had been only three months on his long journey to the Bering Sea coast.

The Canadian Government is taking prompt measures to send relief to the men whom Bartlett left on Wrangell Island. On June 9, Captain Cochran, of the U. S. revenue cutter *Bear*, at St. Michael, Alaska, was instructed by the Assistant Secretary of the Department of the Treasury to endeavor to rescue the *Karluk's* party.

The *Karluk's* drift measured, in a straight line from her starting point off the mouth of Colville River to some sixty miles north by east of Herald Island where she sank, about 590 statute miles. Only to the east of Point Barrow did her course diverge a little to the south of this line; but there were a number of divergencies to the north of it, the greatest of which was about 70 miles north of the line about midway of the drift. The divergencies from a straight course probably increased the length of her journey by at least 200 miles, making the total drift about 800 miles, or an average daily drift of over 7 miles.

The drift of the *Karluk*, the ice journey to Wrangell Island dragging tons of supplies, and Bartlett's long tramp from that island through northeastern Siberia will have a conspicuous place in the annals of Arctic exploration.

XUM

NOTES ON THE DESCRIPTION OF LAND FORMS—XII

Physiography in New Zealand.

THE PHYSIOGRAPHY OF THE MIDDLE CLARENCE VALLEY, NEW ZEALAND. By C. A. Cotton, Victoria College, Wellington, N. Z. *Geogr. Journ.*, Vol. 42, 1913, pp. 225-246.

The geographical factor of distance has been recognized as of value in anthropogeography, inasmuch as its increase tends to weaken the influence of home-country traditions in a colony. The socialistic legislation of New Zealand, strikingly unlike the more conservative legislation of Great Britain, is a well known instance of the operation of the distance factor in governmental matters: the article cited above is an instance of it in geographical matters.

The colonial author of this exceptionally lucid paper discards traditional and conventional British methods and makes conscious application of a comparatively new, systematic and explanatory method in his physiographic description. First comes a page of helpful introduction; next follow two pages of "Brief Description," in which the essence of the story is concisely

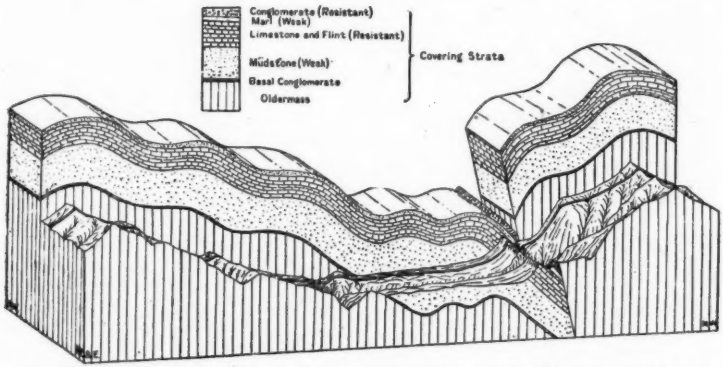


FIG. 1—Diagram illustrating the type of structure and sculpture in the Middle Clarence Valley. (*Geographical Journal*, Vol. 42, 1913, No. 3, p. 227.)

told; fourteen pages are then given to a fuller treatment of six topics that were lightly touched in the "Brief Description"; and four pages of a geological appendix close the article. The illustrations include a location map, an excellent block diagram (Fig. 1), six effective outline sketches, and five photographs. Evidently the needs of the reader have received due consideration by the writer, and, as a result, his work quickly gains due recognition from the reader. When a paper follows a systematic order, as this one does, it gives the impression of a completed story; and a paper that gives the impression of completeness is probably based on a study that was carried through with thoroughness. When a paper possesses, as this one does, the invaluable quality of lucidity, it is highly probable that the investigation on which it was based possessed the equally desirable quality of accuracy.

One here learns that, according to this author, in a great compound mass, consisting of a disordered and worn down "oldermass" originally buried

beneath some 12,000 feet of "covering strata," "two anticlinoria are represented with an intermediate synclinorium" trending northeast-southwest, the northwestern limb of the synclinorium being "replaced by a reversed fault of enormous throw." The anticlinoria no longer preserve their cover, but are deeply carved by normal processes into two one-cycle mountain ranges of strong relief, known as the inland (northwestern) and the seaward (southeastern) Kaikoura ranges. Between them is a long and broad consequent valley-lowland—the Middle Clarence valley, worn down on the weak covering strata of the faulted synclinorium, except that an unconsumed monoclinal ridge of resistant limestone with northwestward dip survives near the fault line at the base of the inland range; but as a result of relatively recent rejuvenation by regional uplift, of which the headwater streams in the mountains do not yet take notice, the main rivers are now entrenched in narrow valleys beneath the remnants of the former lowland floor, save that Clarence river itself no longer flows in the belt of weak covering strata, but is incised in the oldermass along the border of the seaward range, seemingly superposed from a former extension of the cover. Some of the mountain streams "must now be superposed consequents"; others which descend the mountains obliquely instead of directly are perhaps guided by weak belts in the oldermass, and "may be classified provisionally as subsequents."

Special attention should be directed to certain excellent features of Cotton's article. It makes free use, without stopping to explain them, of such systematic terms and phrases as consequent, subsequent, superimposed, antecedent, grade, rejuvenation, normal erosion agencies, one-cycle mountains and elbow of capture, as if its pages were written for mature geographers of some reasonable proficiency in their science. The sequence of parts is carefully arranged, so that the reader advances easily from large features to detailed features. "The account given of the geological structure is limited to the minimum required in explaining the relief"; all geological formation names are relegated to an appendix. The "Brief Description" contains no local, unexplained place-names as guides to the location of physiographic features; only four place names are there introduced and they are located with respect to the physiographic features. On the other hand, it may be questioned whether the historic order of presentation, not followed in the above abstract, is best for the presentation of a visible product of change, not a past process of change; whether the historic style, with its prevalent use of the past tense, is most satisfactory for the description of present forms; whether certain phrases might not be changed to advantage from descriptive explanations to explanatory descriptions; and whether a few more dimensions, such as miles of length and breadth, and feet of height, should not have been added to the "Brief Description." But these are small matters, or rather they are niceties, almost too delicate for mention in the discussion of any articles but the best.

The Lakes of the Balkan Peninsula.

L'ANCIEN LAC ÉGÉEN. By J. Cvijić. *Ann. de Géogr.*, Vol. 20, 1911, pp. 233-259.

This geological article by the professor of geography in the University of Belgrade is largely concerned with the study, which he has most persistently and enterprisingly carried on, of an extensive Pliocene lake that occupied the southern part of the Balkan peninsula, inland from Salonika, as well as part of the later-formed Aegean Sea. The article was probably accepted for publication in a geographical journal because the reconstitution of the extinct lake is based in large measure on physiographic evidence, as well as because the history of the extinct lake contains much excellent and novel physiographic information. The article is here reviewed in order to examine the manner in which its physiographic elements are stated and applied.

The region under discussion contains a good number of existing lakes, nearly a score being shown on one of the maps accompanying the article, some with outlets, some without, but all occupying local basins in what was once the bottom of the extensive and irregular Pliocene lake, to which the name,

XUM

Aegean, is given. The local basins are explained at the outset as "tectonic depressions of recent date," often determined by down-faulted troughs (p. 234). This statement is physiographically incomplete, because it gives no idea as to the character of the surface before it was deformed and faulted; hence the reader is here left in uncertainty as to the nature of the tectonic basins, unless he happens to know beforehand the Pliocene or pre-Pliocene topography of the region. Attention is called to the incompleteness of the statement, because it is an example of a frequently employed but essentially imperfect method of description, which neglects an important three-fold principle of physiographic presentation, namely:—Whenever mention is made of a crustal movement as a factor in the explanatory description of the existing form of a land surface, the form that the surface had before the movement took place and the changes that it has suffered since the movement, as well as a sufficient account of the movement itself, should be included in the statement; in other words, when a cycle of erosion is interrupted by a crustal movement that places the land mass under consideration in a new attitude with respect to base-level and thus introduces a new cycle of erosion, the stage of development reached in the first cycle when it was interrupted and the stage reached in the second cycle since it was introduced, as well as the interrupting movement, should all be stated.

For example, if a certain coastal district is said to owe its present shoreline to a movement of depression, it is essential to know the form that the district had before the depression took place, as well as the estimated amount of depression, in order to conceive the new shoreline in its initial stage; and then to know the changes that have since been produced by river and marine action, in order to conceive the present shoreline. Again, if a district is described as traversed by a fault, it is essential in a physiographic description to know the pre-faulting form of the surface—unless it is all destroyed—and the changes since faulting, as well as the direct effects of the fault itself. In both cases it is, in the present writer's opinion, highly desirable to state the pre-depression or the pre-faulting forms of the districts concerned in terms of the structure of their rock mass, of the agencies that have worked on it, and of the stage reached by the agencies in their work.

In the present case the changes since deformation may be inferred to be small, because the deformation is said to be recent; but these post-deformational changes may not be immediately essential, because the author's object is apparently to indicate the form of his district soon after the deformation took place; yet on a later page (253) explicit mention is made of significant erosional changes produced on the deformed surface before its occupation by the Pliocene lake. The very brief statement regarding the down-faulted troughs and the absence of statement regarding the dimensions of the fault scarps that bound the troughs and regarding the post-faulting changes in the scarps are regrettable, but the omission of the pre-deformational form is a still more serious deficiency in an explanatory description. The deficiency is partly made up on a later page, where it is said that the basins are sunk in a pre-existent "plate-forme" (249); further, that detached fragments of large pre-deformational valleys are still recognizable in the uplands between the troughs; and that domes and other reliefs appear in the basin floors (250-252). This is good as far as it goes; it evidently suggests that domes and other reliefs are to be inferred upon the uplands also, although they are not directly mentioned here, perhaps because they are not directly related to the lake problem. Finally, at the very end of the article (258, 259), a brief statement is made regarding the form of the highlands. Why these illuminating details are distributed through later pages instead of being concisely and pertinently stated at the beginning, and why no brief mention of structure is included when the pre-lacustrine platform is described, is not readily understood. The author presumably had some reason for the distributed arrangement, but the reason is not apparent to the reader, whose mental picture of the region must float vaguely while he reads the body of the article, unless he impatiently looks ahead for help, as some readers do. Would it not be well, in such cases as this, for the author to serve the reader's needs more directly, by describing the fundamental land-forms at the beginning?

The maximum extension of the Aegean Lake is inferred in part from its fresh-water sediments which sometimes spread over the lower uplands, but which, aided by the sediments of the later dwindling lakes, are heavier on the basin floors; and in part from its built shore-line terraces and its abraded benches, of which the highest two have altitudes of 740-800 and of 670-680 meters. The highest terraces and benches, as well as the lower terraces formed during the dwindling of the extensive lake, are not easily apprehended as geographical features from the statements of the text; perhaps the author did not intend that they should be. But inasmuch as they are mentioned, the reader naturally strives to conceive their appearance; and his difficulty is, as before, that the three-fold principle of physiographic presentation, essential for a clear account of such features, is again neglected. First, the initial forms of the lake shores are so imperfectly stated that they cannot be understood; second, the stages reached in the development of the built terraces and the cut benches are not announced, and nothing is told of deltas in connection with the terraces, or of cliffs at the back of the benches, although the benches are said to transect the rock structure and to extend over "vast surfaces" (258); and third, the amount of post-lacustrine dissection suffered by these features is hardly mentioned, although special account is given of certain epigenetic streams which often follow meandering gorges in the resistant underrocks into which they have cut down from the consequent courses assumed on the lacustrine sediments, as the lake waters fell to lower and lower levels. Whether the broad benches are properly interpreted as due to lacustrine abrasion is not here discussed; but it may be noted that corresponding surfaces farther north are said by Cvijić to have been described as normal peneplains by de Martonne.

In so far as the object of the paper is geological, geographical readers must feel grateful to its author for incidentally providing them with so much physiographic material, even though they may regret that the material is not more systematically and effectively presented, as it might easily have been. In so far as the object of the paper is geographical, as might be inferred to be the case from its preparation by a noted professor of geography and its publication in an excellent geographical journal, its readers must more seriously regret that the present consequences of past crustal deformation and temporary lacustrine occupation are not set forth in such a manner that the resulting landscape of to-day can be more definitely and completely pictured. Whether this result could be secured by the adoption of the three-fold scheme of presentation, above indicated, can be best determined by comparative experiment. Let a given district be described first in the way adopted by Cvijić, and next according to the three-fold scheme; and then test the relative success of the two descriptions by reading them to some innocent but competent listener, who is uninformed as to the issue at stake. Experiment of this kind is strongly recommended to young geographers, whose habits in writing geographical descriptions are not yet formed.

W. M. Davis.

GEOGRAPHICAL RECORD

THE AMERICAN GEOGRAPHICAL SOCIETY

The Daly Medal presented to Prof. Dr. Albrecht Penck. On the afternoon of May 13, the Daly Medal for Geographical Research, which had been awarded by the Council to Prof. Dr. Penck, Professor of Geography at the University of Berlin, was formally presented to him, in behalf of the American Geographical Society, by the Hon. James W. Gerard, Ambassador of the United States to Germany, at the Embassy in Berlin. A number of Americans were present, including the staff of the Embassy. The Amerika Institut was represented by Dr. Drechsler and the Amerikanische Handelskammer by President Wolff and Professor Atwood.

Among the distinguished Germans in attendance were the following representatives of the University of Berlin: Prof. Dr. Planck, Rector of the University, Prof. Dr. Max Sering, Dr. A. Rühl, Dr. A. Merz, Dr. Walther Behrmann, and Prof. Dr. Wilhelm Foerster.

The Berlin Geographical Society was represented by Prof. Dr. Gustav Hellmann, President, General von Beseler, Vice-President, Col. Georg Kollm, Secretary General, Prof. Otto Baschin, and Prof. Dr. G. Wegener, Secretaries, and Prof. Otto Behre, Treasurer.

In presenting the medal to Professor Penck, Ambassador Gerard said that his pleasure in placing the Daly Medal of the American Geographical Society in the hands of Prof. Penck was enhanced by the fact that the recipient of the honor had not only made distinguished contributions to geographical science and to knowledge of the geography of Europe but had also, by his field studies and writings, enriched the geographical literature relating to North America.

On receiving the medal, Prof. Penck said that at the outset of his scientific career, his attention had been called to the West, as a region of vast scientific opportunities, by no less an authority than the great geographer, Baron von Richthofen. He, who was now receiving this honor, first visited America in 1897. He returned to it in 1904; and in 1908-1909 he traversed the United States in its whole extent from Maine to California, and from Florida to Washington. It was also his privilege to teach in Columbia University and to witness the growing impulse of geographical science in North America. The medal which the American Geographical Society had now conferred upon him again recalled to his thought that science knows no bounds; and with all the greater pleasure, therefore, he received this honor.

After the presentation the company enjoyed, for some time, the hospitality of Ambassador and Mrs. Gerard.

NORTH AMERICA

A Geological Guide Book for the Exposition in San Francisco. N. H. Darton, of the United States Geological Survey, will spend the summer in the southwest obtaining data for a guide book of the geological features along the Santa Fé railroad from Kansas City to Los Angeles, with side trip to the Grand Canyon. This guide is to be published as a *Bulletin* of the Survey and is intended primarily for the use of travelers to the Panama Exposition in San Francisco in 1915. It will include maps showing the geology and topography in a zone about twenty-five miles wide on a scale of 1:500,000, for which much new field work is required. Many very instructive features of geography, physiography, and geology are presented along this most interesting route and it is believed that a description of them will be of interest to a large number of persons. Brief accounts will also be given of notable scenic features, Indians, history, and local industries.

Surveys in Alaska. The U. S. Geological Survey has placed eleven survey parties in the field, this year, for the working season which continues from June through September.

J. W. Bailey and Theodore Chapin will explore the region tributary to the

Talkeetna River and connect their work with the survey of the Broad Pass region, last year. On returning, the party will survey the region between the headwaters of the Matanuska and Copper Rivers which has been recommended as a railroad route.

R. H. Sargent and Philip S. Smith, with five men and twenty horses, will explore the region between Lake Clark on the east and the Iditarod district on the west, a stretch of country over 100 miles wide which is almost unknown. They will follow a route suggested for a railroad into the Kuskokwim Basin.

A. G. Maddren will investigate the gold placer districts tributary to the lower Kuskokwim.

Stephen R. Capps and C. E. Giffin will carry geological and topographical surveys across the Skolai Pass into the White River Basin and thence to the international boundary. Mr. Capps will give special attention to the newly discovered gold district in the Chisana Basin.

F. H. Moffit and J. B. Mertie will complete the survey of the Kotsina copper bearing area, begun in 1912 but suspended, last year, on account of the delay in the appropriation. B. L. Johnson, with one assistant, will make a detailed geological survey of the Port Valdez gold and copper district.

To coordinate and correlate the various geological surveys in Alaska it is necessary to continue the studies of the general geology and mineral resources. Three geologists will engage in this work. George C. Martin, assisted by R. M. Overbeck, will continue his studies of the Mesozoic stratigraphy, visiting important localities in southeastern Alaska, in the Chitina Valley, and along the Yukon. H. M. Eakin will undertake supplementary investigations of the tin deposits of Alaska. He will examine some of the occurrences of tin in the York region of Seward Peninsula and in the Hot Springs district of the Tanana Valley. Mr. Eakin will also undertake studies of mineral deposits and mining development in the Nome, Fairbanks, and Juneau districts.

Alfred H. Brooks, the geologist in charge of the Alaska surveys and investigations, expects to leave for Alaska as soon as office work permits, probably about the middle of June. He will devote special attention to the problems of Quaternary geology, including the genesis and occurrence of placer deposits. He will visit the Iditarod and Fairbanks districts and, time permitting, the Nome district. Mr. Brooks will also join the Moffit party in the Kotsina district and the Johnson party in the Valdez district for brief periods. (*U. S. Geological Press Bull.*, May 2, 1914.)

The Carnegie off on Another Cruise. The non-magnetic yacht *Carnegie* left Brooklyn, on June 8, for a six-months' cruise in the North Atlantic Ocean in continuation of the magnetic survey of the oceans which is being carried out by the Department of Terrestrial Magnetism of the Carnegie Institution of Washington. The vessel is commanded by Captain J. P. Ault, with Dr. H. N. W. Edwards second in command. She will call at Hammerfest, Norway, and Reykjavik, Iceland.

A Magnetic Expedition to Hudson Bay. A magnetic exploratory expedition will be sent this summer to Hudson Bay by the Department of Terrestrial Magnetism, under the leadership of W. J. Peters, assisted by D. W. Berky. The schooner *George B. Cluett*, of the Grenfell Association, has been chartered. She will leave Battle Harbor, Labrador, on July 1, and return about Oct. 1.

The Territory of New Quebec. That part of Canada lying north of the Province of Quebec and west of the northeast coast region known as Labrador and under the authority of Newfoundland, has long been known as the Territory of Ungava. The legislative assembly of the Province of Quebec has renamed it the Territory of New Quebec. It general features are well known. It is likely in time to develop some economic importance as the trees most favorably situated will supply a profitable lumber industry, and the fisheries in numerous lakes and rivers, when developed, are likely to be very valuable. The total population now is 14,300, made up of 8,800 white settlers, 2,000 Eskimos and 3,500 Indians.

XUM

The International Congress of Americanists. The first session of the 19th International Congress of Americanists will be held at Washington from Monday October 5 to Saturday October 10, 1914. The meetings will be held in the new building of the U. S. National Museum under the auspices of the Smithsonian Institution, the local universities and some of the scientific societies of the capital. The Americanists will visit New York on October 12 and in the afternoon they will visit the Hispanic Society of America and attend a reception tendered by the American Geographical Society at its house from 4 to 6 P. M.

SOUTH AMERICA

The Amazon Expedition of the University Museum, Philadelphia. This expedition left Philadelphia in March, 1913. A statement of its organization and purposes appeared in the *Bulletin* (Vol. 45, 1913, pp. 369-370). It was sent to the Amazon Valley to collect information relative to the aboriginal inhabitants and to explore the forests where primitive peoples still roam untouched by civilization. The June *Bulletin* (p. 441) contained information from Mr. G. B. Gordon, Director of the University of Pennsylvania Museum, that the expedition had reached Georgetown, Guiana, by way of the Corentyn River. Mr. Gordon has obliged the Society with the following summary of the work of the expedition up to the time it reached Georgetown. Until Nov. 8, 1913, the expedition worked in northern Brazil, ascending from the Amazon *via* the Rio Negro and the Rio Branco. From the latter the party ascended in canoes the Uraricoera, near the borders of Venezuela, where the mountainous nature of the country and the waterfalls stopped their progress. They proceeded, however, further than white men had gone before on this river and were in contact with three tribes not hitherto known to science. From the Uraricoera, the expedition traveled overland to Mt. Roraima, and thence across country into British Guiana and the headwaters of the Essequibo. A halt was made at Dananawa, the ranch of Mr. H. P. C. Melville, the only white resident in the southern Guianas and the government agent and protector of the Indians for the whole British territory. Here the expedition was joined by Mr. John Ogilvie, an experienced woodsman. With forty native carriers the expedition then started directly eastward into the unknown region of southern British Guiana lying along the Brazilian frontier. The party carried no provisions, but depended entirely on the wild game and vegetables of the country. On January 8, after passing the country of the Waiwai Indians, the expedition was with the Diows. On that date Dr. Farabee sent Dr. Church back over the route by which they had traveled to bring out collections that had been made up to that time. It was also necessary to reduce the party on account of the increasing scarcity of food as the expedition advanced. Dr. Church arrived at Manáos on March 15 and reported to the Museum. Nothing more was heard from Dr. Farabee until April 20 when a cable was received from him dated at Georgetown announcing his arrival there.

On May 9 a letter was received from him written at Barbados where he had gone to recuperate before starting on another journey into the interior. He said that the expedition continued to travel eastward from December 16 to April 1 through territory that had not been penetrated and was inhabited by tribes that had never seen white men. These natives had never seen such articles of civilization as matches or guns, salt or clothing. A halt was made with each tribe in order to study languages and customs and to make collections. The tribes visited after the Waiwai were the following: Parikutu, Waiwe, Chikena, Katawian, Toneyan, Diow, Kumayenas and Urukuanas. At this time the party consisted of two white men and four natives, for it was found that a larger party could not live on the country. The direction of the journey was at right angles to the watercourses and involved the crossing of one divide after another. As each river was reached canoes were built and the rivers explored up and down. The ammunition became low, but the Indians procured game and fish with their bows and arrows. Dr. Farabee hoped to find a river flowing east or southeast, but finding instead one which flowed northwards and being stricken with fever, he decided to build canoes and descend this river

which proved to be the Corentyn. The party thus arrived at Georgetown on April 19. The letter says that important collections have been sent to the Museum as a result of the trip.

An Expedition to Peru. A topographic party under the leadership of E. C. Erdis sailed for Peru on May 2 to prepare maps of a part of southern Peru including the Cordillera Vilcabamba and parts of the Apurimac and Urubamba basins. This region is one of the most inaccessible parts of the Andes and is very poorly mapped. The work of this party is preliminary to the mission of the main expedition which probably will not set out until early next year. Mr. Erdis and his men will make maps for the use of the scientific staff that is to follow. Dr. Hiram Bingham is Director of the expedition and Prof. Herbert E. Gregory is geologist. The expedition is going out under the joint auspices of Yale University and the National Geographic Society. It will spend about two years in the field. The study of the ancient ruins known to exist in this region and of the land areas that the former peoples of Peru occupied is the main purpose of the expedition. (*Science*, May 8, 1914, pp. 679-680).

ASIA

Stein's New Expedition. Sir Aurel Stein, on his new expedition to Central Asia, reached the neighborhood of Lop-nor in January last, after carrying out a part, at least, of his proposed winter campaign in the desert. Writing from Camp Miran, Lop-nor, on January 19, he reports that he had seen a good deal of the desert, partly by new routes, but had been obliged to move quickly in order to be in time in reaching a corner of the Tarim basin to which the explorer is drawn by a combination of geographical and archæological interests, and where work is possible only in the winter. He wrote from the site of the old Lop "capital," where he had succeeded in recovering interesting remains, and was then busy with preparations for a move through the desert northeastward, with a view to pushing on into Kansu. Political conditions were still somewhat unsettled, but had not, so far, interfered with his work, though it was clear that the revolution in China had not changed things for the better in those parts. In spite of the advanced season and the severe cold, the triangulation along the Kuen Lun had been extended well to the south of Lop-nor. (*Geogr. Journ.*, Vol. 43, 1914, No. 4, p. 440.)

EUROPE

Descent into the Crater of Vesuvius. In December, last year, Mr. Storz made a descent into the crater of Vesuvius. He clambered down the crumbling crater edge to the opening into the depths on the south side. The wall enclosing this opening is steep on the south side but of gentler slope on the north side of the crater. The new opening, as is known, was formed on July 5, 1913. A short time after the enlargement of the opening the lava rose in it almost to the edge, then sank to about 300 feet below the edge. This was the position of the lava at the time Storz made his descent. Gaseous ebullitions were from time to time being violently expelled. Storz found that the temperature within the opening rose very rapidly. About thirty feet below the edge of the opening the temperature was about 334° C., at fifty feet, 483° and at 200 feet, 632°. Further temperature measurements could not be carried out because the thermometer was lost. As the iron cable used by Storz slipped easily into the opening its wall appears to be practically perpendicular for at least 200 feet from the top. (*Zeitschrift der Gesellschaft für Erdkunde zu Berlin*, 1914, No. 3, pp. 226-227.)

A Periodical on Vulcanology. The *Scottish Geographical Magazine* comments on the first number of the *Zeitschrift für Vulkanologie* edited by Mr. Immanuel Friedlaender of Naples and devoted to problems connected with volcanoes and volcanic action. It is to appear at irregular intervals. Mr.

XUM

Friedlaender, in his preface, says he has been trying for some years to found an international volcanic institute at Naples but has met with financial and other difficulties. He has therefore established a private institute on a modest scale and is issuing the new journal in connection with it. The publication will contain both original contributions and summaries, abstracts, etc. The first number has several original papers, the English, German, Italian and French languages being represented. It contains a number of fine illustrations of Vesuvius and other volcanoes.

POLAR

Antarctic

An Anglo-Swedish Antarctic Expedition. *The Geographical Journal* (Vol. 43, 1914, No. 5, pp. 554-558) prints details of an Anglo-Swedish Antarctic Expedition which it is proposed shall leave Europe in August, 1915, for West Antarctica, to the south of South America. It is expected to establish headquarters in the northern part of West Antarctica. The first summer will be given to rearing the station but, if ice conditions permit, a trip will be made southward on the vessel to visit the depôts left by the Swedish Antarctic Expedition of 1901-1903 on Snowhill Island and to prepare for future sledge expeditions. For the rest, the winters will be chiefly utilized in studying the environs of the station and the spring and autumn will be devoted to sledge expeditions. During the summer the staff will be busily employed on scientific work upon the vessel. The committee has estimated the cost of a vessel and the initial erection of the station at about $20,000, most of which has been promised by two Swedish patrons. The annual expense of maintenance, if the cooperation of the whaling companies is realized in transporting plant and keeping the station in touch with the outer world, is estimated at about $15,000. Half of this amount the Swedish committee hope to obtain by a grant from the Swedish Parliament. The trustees of the British Museum have pledged an annual grant of $2,500 for five years, the Royal Society has granted $2,500 for the first year and England's share in the undertaking promises to equal that of Sweden. It is intended to divide all collections between English and Swedish museums and two places on the staff will be reserved for English scientists.

The expedition is expected to complete the work so admirably begun by Professor Otto Nordenskiöld in 1901-1903. The important discoveries of the Nordenskiöld Expedition showed that this tract of Antarctica is well worthy of thorough study and that science and the museums may be provided with much fresh material from the treasures discovered.

The whole region will be mapped in part from the vessel and in part by means of sledge expeditions in the summer on the land ice. Another great question which the expedition will endeavor to solve will be the connection between West Antarctica and the true Antarctic Continent. Filchner's German expedition hoped to solve this question but did not succeed; it is one of the objects of other expeditions that are now preparing for departure with their base at the south of Weddell Sea.

Arctic

The Amundsen Expedition to the Arctic Ocean Postponed till 1915. Captain Roald Amundsen proposed this summer to enter the ice of the Arctic Ocean starting from Point Barrow. To reach Point Barrow in time for his enterprise it was necessary for the expedition to leave San Francisco not later than early in July this year. His vessel, the *Fram*, went to Colon in September last expecting to be the first vessel to pass through the completed canal this year. While awaiting there the opening of the canal the date of that event was indefinitely postponed on account of the landslides in the Culebra Cut. Lieut. Nielsen, who was in charge of the *Fram*, was therefore instructed to sail for San Francisco *via* the Straits of Magellan on his way to Point Barrow. As the *Fram* is a slow sailer she was expected to be some months on

the way to San Francisco. On March 25 a telegram from Montevideo announced that the *Fram* had put into that port to go into dry dock for repairs and that one of the most useful members of the party, the first ice pilot, had died during the journey from Colon. Under these circumstances the *Fram* could not reach San Francisco by July and Captain Amundsen found it necessary to announce the postponement of his Arctic enterprise until next year. Cable orders were sent to the *Fram* to return to Norway where she will take on the supplies that were to have been sent by rail from New York to San Francisco. It is now intended that the *Fram* shall start early next year for San Francisco and the Arctic Ocean *via* the Panama Canal.

PERSONAL

Dr. L. A. Bauer, by request, repeated his lecture on the "General Magnetic Survey of the Earth" before the New York Academy of Sciences on April 30 and before the New York Electrical Society on May 25. This lecture was first given before the joint meeting of the American Geographical Society and the Association of American Geographers on April 3. Dr. Bauer also gave four lectures (May 4-7) on "The Earth's Magnetism," at Johns Hopkins University.

Professor Hiram Bingham of Yale University lectured before the New York Academy of Sciences on March 23d on "Recent Exploration in the Land of the Incas" with lantern views.

Professor Henry Cowles of the University of Chicago, retiring President of the Geographic Society of Chicago, gave an illustrated lecture before the Society on May 8 relating to his observations and experiences in guiding a party of distinguished plant geographers through the western United States in the summer of 1913. Among the places visited were the Colorado Rockies, Mt. Rainier, Crater Lake, the Yosemite, Salton Sea and the Santa Catalina Mountains of southern Arizona.

OBITUARY

EDUARD SUESS. Professor Suess died in Vienna on April 26. He was born in London on Aug. 20, 1831. His family removed, while he was a boy, to Prague and later to Vienna. He was Austria's most eminent man of science and one of the world's greatest geologists. In 1857 be began his career as a teacher, served ten years in the University of Vienna as associate professor, and was appointed in 1867 to the full professorship of geology, a post that he held for 34 years, retiring as Emeritus Professor in 1901. He numbered among his pupils Neumayr, Penck, and other distinguished scientists. In an obituary notice of Suess written for *Nature* (May 7, 1914) by one of his pupils, John W. Judd, the writer says that over sixty memoirs and books were published by Suess prior to 1875 and his researches ranged over every branch of geological science. In that year appeared his remarkable work "Die Entstehung der Alpen" which was followed five years later, by the first part of the still more famous "Antlitz der Erde." In this great work, which engaged him during twenty-five years, he undertook the enormous task of taking a comprehensive survey of all that had been accomplished in elucidating the geological structure of every part of the world; and he drew general conclusions from that survey. It was a monumental work of great merit, of small defects, and the influence it exerted was enormous. The book has taken its place among the great scientific classics. The great task of his life was completed in 1910 and his days since then have been happy and restful for it was only recently that he was attacked with the bronchial affection which terminated his life in his eighty-fourth year. He declined many offers of honors and titles but received the highest marks of appreciation from his fellow workers in science. He was president of the Austrian Academy of Sciences, member of the French Institute, and foreign member of the Royal Society from 1894.

ADOLPH FRANCIS BANDELIER. The death of Mr. Bandelier, at Seville on March 18, has robbed the world of a most brilliant and versatile historian and anthropologist. In learning and critical ability he was head and shoulders

XUM

above any man who has yet devoted himself to the study of Colonial Spain and of the native races and civilization which it embraced. He has left an imperishable stamp on American anthropology, and has set a standard for scholarship and research which should be an inspiration to the younger generation.

He was born in Berne in 1840, the son of a Swiss gentleman of old nobility who held high office in the little Bernese republic. In 1847 his father, disgusted with the overthrow of the old conservative party in his native state, emigrated to America and settled in the town of Highland, Illinois. There Adolph Bandelier grew up in simple surroundings which might seem to give little promise for a student. But with an indomitable energy and thirst for learning he fought his way, and like the young Schliemann mastered every obstacle in the path of his scientific education. In boyhood his favorite study was natural history, a little later he turned to mineralogy, geology and chemistry, then to meteorology, in which connection he published, after eleven years, an important series of studies of the aurora borealis.

In 1857 and again in 1867 he visited Europe, where he was well received in many circles and formed valuable connections for his scientific interests.

In 1873 Lewis H. Morgan, the famous anthropologist, made the acquaintance of Mr. Bandelier and this was destined to be the turning point in the latter's career. Morgan awoke his interest in archæology and ethnology, but the time had not yet come when Bandelier could take the field for practical work, and for several years he was obliged to be content with a book-study of the history of Mexico and Spanish America. During this time he published his two important monographs in the *Reports of the Peabody Museum*. These brought him into such prominence that in 1880 Morgan was able to offer him the command of a scientific expedition to work among the Pueblo Indians of New Mexico. It was the beginning of a career of ceaseless exploration and literary activity which continued for thirty-four years.

From 1880 to 1890 his principal work was published by the Archæological Institute of America, and a glance at the index of the Institute's *Reports and Papers* will show the range and extent of his studies during that time. He made journeys all over Mexico, New Mexico, and Arizona, at a time when traveling meant real exploration among savage tribes.

At the end of 1890 the Archæological Institute was obliged to close its work and Mr. Bandelier then turned his attention to a new field. He had long been interested in South America, and in 1892 Mr. Henry Villard sent him out to the west coast of South America, where he continued his researches and explorations, chiefly in Peru and Bolivia. During the next twelve years, in addition to making archæological surveys over a wide field, he formed large ethnographical and archæological collections which are now in the American Museum of Natural History at New York.

A picture of Bandelier's work at this time is given by Sir Martin Conway in his paper on the Bolivian Andes in the *Geographical Journal* of the Royal Geographical Society (Vol. 14, 1899, pp. 22-24), and a sketch of his life and activities up to the same date was written by his intimate friend Señor M. V. Ballivian for the *Oficina Nacional de Propaganda Geografica de La Paz*.

In 1904 he returned permanently to New York where he lived for the next eight years, often in ill health and with failing eyesight. In 1912 he had recovered a considerable measure of health, and passed the winter in Mexico City collecting material for a work already far advanced on the Documentary History of the Rio Grande Pueblos. It was to continue this that the Carnegie Institution sent him, last October, to Spain, where he began what promised to be a long course of research in the archives of Seville. That he should have been cut off in the midst of this important undertaking, while still in the fulness of his unsurpassed mental powers, is a misfortune for the world. We can only hope that his widow and devoted collaborator, Madame Bandelier, may be enabled to complete and put in order what he has left. Mr. Bandelier was a true man of science, fearless and sincere in criticism, tireless in construction and singularly unaware of his own eminence. The list of his principal writings in English is reserved for later publication. DAVID RANDALL-MACIVER.

GEOGRAPHICAL LITERATURE AND MAPS

(INCLUDING ACCESSIONS TO THE LIBRARY)

BOOK REVIEWS AND NOTICES

(The size of books is given in inches to the nearest half inch)

NORTH AMERICA

Drainage Changes in the Shenandoah Valley Region of Virginia. By Thomas L. Watson and Justus H. Cline. *Bull. Philosoph. Soc., Univ. of Virginia,* Scientific Series, Vol. I, 1913, No. 17, pp. 349-368. Charlottesville, Va.

One of the most interesting areas in America for the study of drainage modifications is included in the Appalachian Mountain belt of Maryland, Virginia and West Virginia. The present paper deals with the development of the Shenandoah, a typical subsequent stream, and its branches. It is shown that a series of southeastward flowing rivers crossed a low ridge of resistant rock through narrow water gaps. Subsequent branches of the larger transverse streams developed on a belt of weak rock on the upstream side of the ridge, capturing the headwaters of weaker neighboring streams and leaving wind gaps to mark their former paths across the ridge. Ultimately one subsequent branch (Shenandoah) of the master transverse stream (Potomac) succeeded in beheading its temporary rivals southward to the James. The altitude and size of the abandoned wind gaps through the ridge (Blue Ridge) enable the authors to reconstruct the former drainage at different epochs and to determine the relative size of some of the streams and the order of the successive captures. Numerous maps and photographs have been used to illustrate the discussion. Further account of drainage changes in this region is promised in a future paper.

The discussion of the early drainage history of the region is not convincing, because the authors do not seem to distinguish between the surface drainage due to the Appalachian folding and the drainage on the warped peneplain surface of much later date. Superposed streams are mistaken for antecedent throughout the paper, and the same rivers are called both consequent and antecedent. Even the later drainage history is in places open to question, for Ashby Gap, which is cut more deeply into the Blue Ridge than others which are given great prominence, is omitted from all the maps, and no account is taken of it in reconstructing the former drainage. One misses a statement of the comparative elevations of different wind gaps and other essential details of evidence, and must rest content with the authors' conclusions when he would like to have in addition the facts on which the conclusions are based. Future papers on this important region would also gain in clearness if all the local places to which physiographic descriptions are referred could be shown on the maps.

An Industrial History of the American People. By J. R. H. Moore. xiii and 496 pp. Ills., index. Macmillan Co., New York, 1913. $1.25. 7½ x 5.

The attempt is to present, for high school courses in history, a text-book which is practical, or as stated in the preface, "profitable." There seems no doubt that the interest of the boy or girl will be held by a book of this type much more effectively than by those histories which still give the impression that the political progress of the world's nations has been more often the result of the whims of personalities than the effect of natural causes. The discussions bring events "to earth" by finding their causes in the topography, soil, climate, location or some other natural basis.

The book is divided into thirteen chapters treating, in the main, nine subjects: Fisheries, Lumber, Fur Trade, The Labor Problem, Agriculture, Com-

XUM

merce and Finance, Colonial Government, The City Problem, and Manufacturing. Each subject is treated from the beginning of American history and brought to date. It is not always apparent that the principal subjects of any two chapters bear some relation to each other. The material ought to be more closely woven. The basic idea of the book is excellent and as more or less of a pioneer in the field it deserves full commendation.

Maps are conspicuous by their absence. The few modern maps are all very poorly drawn and lack in information that seems essential to an industrial history. The photographs are good and numerous but not closely associated with the text. The 491 pages constitute too large a text-book. In its present form it will probably be best adapted for a book of reference or supplementary reader.

EUGENE VAN CLEEF.

The Immigration Problem. A Study of American Immigration Conditions and Needs. By Jeremiah W. Jenks and W. Jett Lauck. 3d edition, revised and enlarged. xxiii and 551 pp. Index. Funk & Wagnalls Co., New York, 1913. $1.75. 8 x 5½.

Upon the printing of the first edition, this work came into its own as the standard commentary upon the unwieldy library of the reports of the Immigration Commission. The present edition has been wholly revised, largely rewritten, and contains the results of the final coordination of tables given by the Commission. It will serve as a guide and compendium for those who wish to study the problem of immigration as set forth in the reports of the Commission; and to the student of the sociology of modern folk movement it will prove invaluable.

WILLIAM CHURCHILL.

Game Protection and Propagation in America. A handbook of practical information for officials and others interested in the cause of conservation of wild life. By Henry Chase. v and 238 pp. J. B. Lippincott Co., Philadelphia, 1913. $1.25. 7½ x 5½.

A thorough treatment of this most important topic including the propagation of game fish and the pollution of fishing waters. The author does not think that more legislation is necessary but he favors greater strictness in the enforcement of the game laws, shorter open seasons, and large tracts reserved, as to game, with no open season. The fact that game protective associations are being formed all over the country he regards as an encouraging sign of the growing interest in the conservation of wild life.

Dry Land Farming. By Thomas Shaw. xxx and 460 pp. Ills., index. The Pioneer Co., St. Paul, Minn., 1911. $2. 8 x 5½.

The dry land area of the United States and Canada includes approximately not less than 500,000,000 acres. Nearly all of this land is unusually rich in the elements necessary for plant growth. These millions of acres may be put under cultivation with the certainty of reaping an abundant harvest, provided water is supplied by irrigation and dry farming is carried on in the correct manner. Methods employed in humid farming regions will not succeed in these dry regions, and it is the aim of the author to make this book a guide to success in the new science of dry farming.

Among the many subjects which Mr. Shaw considers, are the following: history of dry farming; soils; rainfall; soil moisture; plant growth; plowing; planting; cultivation; harvesting; crops, trees and fruits that may be grown successfully; rotation of crops; water supply for irrigation, and in fact, all topics having a bearing on the dry farming industry. The book is written in a clear, concise manner, and should be of value to all those interested in this subject.

WILBUR GREELEY BURROUGHS.

The Vanishing Race. The Last Great Indian Council . . . and the Indians' Story of the Custer Fight. By Dr. J. K. Dixon. xviii and 222 pp. Ills. Doubleday, Page & Co., New York, 1913. $3.50. 10 x 7.

This handsome volume, "the concept of Rodman Wanamaker," forms a fitting setting for the attractive photogravures of Indian chiefs and scenes

from Mr. Wanamaker's camera. The introductory summary of Indian manners and customs, written by Dr. Dixon, follows rather the ideal pictures of Cooper's novels than the reality of Indian life as depicted by Schoolcraft and other Indian ethnologists. The personal narratives of the Indian chiefs gathered at the "last great Indian council in the valley of the Little Big Horn, Montana, in September, 1909," are of great interest. They make clear that before the coming of the White Man, Indian life was one of tribal forays and internecine strife, as was common among the savage Scotch and Irish clans. They corroborate what was already known about the Custer fight, that Reno's cowardice and disobedience of orders were responsible for the annihilation of Custer and his seven troops of the Seventh U. S. Cavalry. They also correct the common error that Sitting Bull was the Indian general, who outmanoeuvered Reno and overwhelmed Custer. Sitting Bull was the priest, the medicine man, whose incantations made the warriors invincible. Chief Gall was the strategist who won the day. DAVID H. BUEL.

SOUTH AMERICA

Argentinien, ein Land der Zukunft. Von General A. Arent. 3. Auflage. 250 pp. Maps, ills. Max Steinebach, München, 1913. Mk. 7.50. 9½ x 6½.

This badly printed volume adds little to our knowledge of the Argentine Republic, except as regards the army, where the author speaks with competence. The material of the army, the gaucho, he regards as superior to that of any European army, as physically vigorous, accustomed to a life like that of an army in campaign, and expert with horses. He has no good word for the handling and officering of this army. Officers are too numerous, 1500 above lieutenants to 7000 men in 1900. Economy is unknown and little progress is made toward efficiency. However, since 1906, twenty-five Argentine officers have been getting training in the Prussian army.

Gen. Arent regrets that the Germans do not emigrate more to the Argentine, instead of to Canada and the United States, where they are "lost" to Germany. He does not see what they can like in our land of corruption and lynch law! Has he not pointed out the dear land of the Argentine, and have not the Germans in America Teutonic intelligence enough to know when they are well off? MARK JEFFERSON.

En Argentine. De Buenos-Aires au Gran Chaco. Par Jules Huret. 529 pp. Index. De la Plata à la Cordillère des Andes. 546 pp. Map, index. Bibliothèque-Charpentier, Paris, 1912 & 1913. Fr. 3.50 each. 7½ x 5.

There is little excuse for ignorance about the Argentine Republic with books like these about. Huret wrote these chapters for *Le Figaro* and they are very brightly written, the best account of the Argentine people that I know, both newcomers and old creoles. English and German writers mostly fail of sympathy with the Argentines and this sympathy M. Huret has. Nor is it one-sided. It is France and above all Paris that in South America stands for culture. The French are *personæ gratæ* in the southern continent. None the less, perhaps, because the French have not been so forward as the English and Germans to see commercial opportunities in those countries. Huret tells how a French firm declined to send workmen out to Chile to set up an iron furnace because they "did not know the country" and a German firm got the contract; how the English borrowed money of French bankers at 4 per cent. to build railroads that have netted them 8 and 12 per cent. However, neither Germans nor English are much liked, precisely because of the excellent profits they have known how to get out of the country.

As to the impending displacement of the English by Germans in all large business undertakings out there, the present reviewer is getting a little skeptical. He was told it was imminent thirty years ago when he lived there, that the English could not possibly long maintain themselves against the competition of "cheap" Germans. The evidence of the process was plain enough

XUM

to see everywhere, but the fact remains that the English are still there and still strong there! The author is a skillful word painter and visited almost every corner of the republic. He relates the stories of innumerable immigrants in many provinces, some failing to make good and many thriving. It is very vivid, as for instance the banquet of the 300 one-time French peasants of Piguet to commemorate the twenty-fifth anniversary of their colony at thirty-five francs a plate! A thousand useful pages. MARK JEFFERSON.

AFRICA

The Conquest of the Desert. By William MacDonald. xii and 197 pp. Ills. T. Werner Laurie, Ltd., London, 1913. 7s. 6d. 8½ x 5½.

The author tells of the progress now making in the Cape of Good Hope and the Transvaal in reclaiming desert lands for tillage by means of dry farming and irrigation. One of his sketch maps shows considerable advance of settlers into the southwestern, south and southeastern parts of the Kalahari Desert due in part to irrigation possibilities offered by the Orange River and to dry farming. The author is enthusiastic over the prospects of developing even the most unattractive parts of the Union of South Africa by means of dry farming and afforestation. The Kalahari he says belongs to the dry farmer. The book is full of data concerning the development of the drier portions of the British territory. His long official association with the work he is promoting gives Mr. MacDonald unusual authority to speak on this topic.

Pemba, the Spice Island of Zanzibar. By J. E. E. Craster. 358 pp. Map, ills., index. T. Fisher Unwin, London, 1913. 12s. 6d. 9 x 6.

Zanzibar and the neighboring island Pemba supply seven-eighths of the world's crop of cloves and the Pemba crop is about three times as large as that of Zanzibar. It is surprising that so little has been known of the island that supplies most of the clove crop. Captain Craster was assigned by the Ordnance Survey to make a topographic survey of the island for the Zanzibar government. It was not an easy task, for Pemba (area, 300 sq. miles) lies low and is well wooded, conditions that emphasize the difficulties of a topographic survey.

The work began in May, 1911, and was completed in February, 1912. A sketch map shows the contours of the tortuous and deeply indented coast and the distribution of cloves, bush and mangrove. The book gives much information about the inhabitants, their condition and occupations. The clove crop varies greatly from year to year. In good seasons the clove pickers often let their other crops go to ruin in order that they may gather the whole of the more valuable clove harvest. The book contains a great deal of information somewhat diffusely and unsystematically presented after the manner of popular books. But it is our best source of reference for a renowned and important island.

Ostafrikanische Landwirtschaft. Reiseschilderungen von C. Hanisch, J. Schmidt und G. von Wallenberg Pachaly. 164 pp. Map, ills. *Arbeiten der Deutschen Landwirtschafts-Gesell.*, No. 230. Berlin, 1912. 9½ x 6½.

The three authors of this book describe their impressions of a visit to German East Africa under the auspices of the German Agricultural Society. Hanisch gives a diary of the trip, v. Wallenberg Pachaly records his hunting adventures, and Schmidt contributes a topical review of the most important tropical cultures of the colony. Cotton,—mostly the Egyptian varieties, upland, and Caravonica,—is grown in increasing quantities, but its culture cannot be said to have passed the experimental stage because neither the climate nor the soils of the country are as yet well enough known to allow the drawing of general conclusions from individual results or failures. Rubber has so far proved a paying investment. It is to be seen, however, whether it will be able to stand the competition of the East Asiatic product, which may be ex-

pected to arise within a few years. Hemp is the most encouraging culture; it is not particular about soils and can stand even long periods of drought. Coffee, most of which is grown in Usambara, was at first disappointing because the managers of the plantations who had been brought mostly from Java, Ceylon, and Brazil, introduced the methods of culture in vogue in their own countries regardless of the climatic differences between those countries and East Africa. After this mistake had been recognized, the production increased steadily in quantity and quality; especially the volcanic soils at the foot of Kilimanjaro and Meru (province of Moschi) are now producing an excellent coffee. Of the other products, copra and rice promise good returns in not too remote a future, while tobacco does not, except in the Kilimanjaro region. The most important cultures of the natives are millet, Indian corn, sweet potatoes, peanuts, and bananas.

The map illustrating the distribution of the tsetse fly deserves especial mention. The pictures contain many characteristic views of the landscape and vegetation.

M. K. GENTHE.

Das neue Kongogebiet (Kamerun, Deutschkongo). Von F. Berthold Krüger. 65 pp. Ernst Marré's Verlag, Leipzig, [no date]. 9½ x 6.

Although this is the merest tract, its pages contain a very satisfactory amount of invaluable information concerning the Kamerun. Introducing his theme with a brief narrative of its discovery history the author presents, in the immediately following pages, a concise record of the land and its people so far as they condition the activities of new settlers. His chief end is to supply helpful hints which may prevent thoughtless adventurers from seeking to help failing fortunes by breaking new ground in the colony and which may equally serve to assist those who, after due consideration of all the arguments, decide to establish themselves in this new land of Germany. It is a very practical piece of writing and therefore of great value.

WILLIAM CHURCHILL.

Les Lois et l'Administration de la Rhodesia. Par Henri Rolin. xlvii and 532 pp. Maps, index. E. Bruylant, Brussels, 1913. Fr. 12. 10 x 6½.

The first two chapters contain a short biography and appreciation of Cecil Rhodes, and a brief history of the origin and development of the British South Africa Company. It was established in Mashonaland by usurpation of the power of the native king, and in Matabeleland by conquest. In North Rhodesia the authority of the company was based mostly on voluntary treaties with the natives, excepting only the Awemba and Angoni in northeast Rhodesia who had to be subjected by force. What distinguishes the British South Africa Company from similar chartered companies is that it has continued to exist and practically to govern and own the country long after its purpose of winning it for the British Empire had been fulfilled. In spite of the nominal "power and jurisdiction" of Great Britain all the really important affairs of the country are transacted at the office of the company, especially in North Rhodesia with its 2,000 white inhabitants, against 23,000 in South Rhodesia. This has the great advantage of not having colonial questions settled by officials thousands of miles away, but its drawback is the combination of power and commercial interests which this singular government represents. The conflicts arising from this extraordinary situation are worth the study of the jurist as well as the political economist. In this book, the author discusses the political, judicial, and administrative organization of the country, the financial situation, the race question, the problem of the ownership of the soil, the labor problem, the police system, the taxation and education of the natives, the claims of the white settlers, the mining possibilities. In spite of the great material progress which is recorded in these chapters, one cannot help asking whether, in the long run, a policy which tends to transform the mass of the natives from free owners of the soil into an industrial proletariat can have beneficial results for both the country and its inhabitants of either race.

M. K. GENTHE.

XUM

ECONOMIC AND COMMERCIAL GEOGRAPHY

Industrial and Commercial Geography. By J. Russell Smith. xi and 914 pp. Maps, ills., index. Henry Holt & Co., New York, 1913. $4. 8½ x 6.

With the publication of this volume of 900 pages, containing about 250 illustrations, a new type of geography is made available. The book is almost too large and detailed to be regarded as a "text book" for ordinary class use. It can and will be used as a college text book, and in skillful hands may be made to serve this purpose excellently, but a still more serviceable text book can be made of it by judicious omissions which shall preserve the general plan of the present book while reducing it one third in size. Every American geographer will nevertheless welcome it in its present form, for there is need of a book which presents the principles of industry, commerce and transportation at least as fully as this book does. The author is a Professor of Industry in a School of Finance and Commerce. His training and his interests lead him to lay the emphasis upon the economic factors in commerce and industry more fully than upon the purely geographical factors such as climate, soil, topography, coast line, etc. Indeed, of these four terms only "climate" appears in the index and that with but two references. For example, there is a good chapter on "The Place and Nature of Agriculture," but in that chapter no paragraph deals with the importance of either soil or climate as factors in agriculture. The word "rainfall" occurs once in the chapter and the six rainfall maps printed in the chapter are not referred to in it; but the word "cost" occurs again and again. These instances are cited to illustrate the minor stress which is laid upon the purely geographical topics.

On the other hand, the geographical influences which affect industry and commerce are again and again mentioned and they are fully recognized as great, underlying factors. There unquestionably is a place for an economic geography, written from the point of view of one who is primarily an economist.

Part I, "Industrial Geography" (670 pages) deals with each of the great commodities of commerce, the cereals, starch foods, animal foods, sugar, etc.; also with the great lines of industry, manufacturing, forest industries, metal industries, fisheries, etc. Part II, called "Commercial Geography," deals with trade routes, ocean transportation, trade centers, etc. Chapters III to XI in Part II give accounts of the trade routes of the various lands and seas. They are largely made up of information presented in considerable detail. In contrast to these chapters is XIII, "The Trade Center and Its Development," a chapter filled with ideas and rich in suggestion. These two types of chapters illustrate one of the distinctive qualities of the book and show why it is a blending of the text book and the treatise.

Because of differences in training and consequently in point of view, men will differ in their conception of the right way to treat industrial and commercial geography. Practically all of our secondary school books make a country— *e. g.*, Germany, France, Japan, the United States—the unit of treatment. Some, like Brigham's, make a few important commodities units of treatment, but devote the larger amount of attention to countries. Chisholm's Handbook treats both commodities and countries as units.

Professor Smith does not make countries units of treatment at all, although they are repeatedly referred to. For instance, the silk industry of Japan is discussed in the Chapter on "Fibers, Textiles and Clothing"; and paper making in Japan in the Chapter on "Forest Industries and Paper," and so on. Any one desiring to get a connected idea of the industries of Japan must gather it up from many places in the book. There are some who hold the belief that a book on geography—if it is to be a "geography"—should include regions or countries as units of treatment, though not necessarily to the exclusion of other kinds of units, such for example, as important commodities, trade routes and trade centers. There is a distinction between a text book of commerce and industry and one on commercial and industrial geography. The former may well be an equally valuable contribution to the broader field of industry and commerce of which field the geographic phase is a part.

It is not desired to press this point unduly, for the volume contains a vast amount of material of geographical character, and it places within easy reach of students, teachers and others a wealth of information and ideas that have not heretofore been readily accessible. R. H. WHITBECK.

EDUCATIONAL

Studies in Geology. A Laboratory Manual Based on Topographic Maps and Folios of the United States Geological Survey, for Use with Classes in Physiographic and Structural Geology. By Rollin D. Salisbury and Arthur C. Trowbridge. 68 pp. Henry Holt & Co., New York, 1913. 7½ x 5.

The manual is one of the most helpful aids to students of physiography that has appeared. The directions are clear, the questions are well chosen and call for thought as well as observation, and the subject is well covered in the seventeen chapters. Any one fitting out a laboratory for physiographic study will find in these "studies" a list of tested and valuable maps for class use. The volume is one of the best of the many that have recently appeared in the same field. RICHARD ELWOOD DODGE.

An Elementary Practical Geography for Middle Forms. By Frederick Mort. 91 pp. Maps. Blackie & Son, Ltd., London, 1909. 2s. 8½ x 6½.

A simple and suggestive volume devoted principally to map study, map making and climatic observation. In some cases the subject considered is so simplified as to be indefinite, and the volume as a whole is not adapted to American purposes. The chapters on surveying are the most helpful.
RICHARD ELWOOD DODGE.

A Geography of the British Empire. By A. J. Herbertson and R. L. Thompson. In series: The Oxford Geographies. 253 pp. Maps, index. Clarendon Press, Oxford, 1912. 7½ x 5.

The British Isles fill about half of the volume. Diagrams or black-and-white maps are particularly numerous. Questions and exercises conclude the chapters. Emphasis is laid upon physical features and climate, but the human side is not slighted. There is a manifest intent to emphasize those geographical facts which people generally like to know about, yet there are unaccountable omissions. For example, space is found to speak of the many races, and the successive invasions, and occupations of India, yet there is not a word about the most characteristic of all Indian social institutions, the caste system. Cause and consequence are plainly brought out in places. The authors hold that "Three factors—relief, climate and soil, control not only plants, and through them animals, but man himself and even the ideas of man." In the treatment of the British Isles, historical geography receives some attention. The great number of details makes the book interesting to read but difficult to teach. R. H. WHITBECK.

Physical Geography for Schools. By Bernard Smith. viii and 190 pp. Ills., index. Macmillan Co., New York, 1911. $1.10. 8½ x 5½.

This text-book is designed to meet the needs of classes in Great Britain of the American high school grade. The first fourteen chapters give a familiar treatment of the usual forms and processes of the science. The fifteenth considers the geological history of Great Britain, a topic which seems hardly appropriate in a school geography. The last chapter of less than four pages is given over to environmental influences. The "typical American" will be startled to read here that his "cast of countenance" is now strikingly similar to that of a Red Indian Chief. But he will be amused to note in a nearby illustration entitled "British Sailors" a face as closely resembling an Indian's as one would find in a week's travel among Americans. Other brief examples of influences on life are given at the ends of many of the chapters. Other

XUM

chapters give no such treatment even though the subjects offer wide and important opportunities, as is the case with glaciers. This meager consideration of the life side of the problem does not follow recent tendencies among American geographers.

The excellencies of the book lie in the full treatment given the British Isles both in text and illustrations, the extended adoption of the proposed technical terms of the science, and the admirable half-tone illustrations.

SUMNER W. CUSHING.

A Practical and Experimental Geography. By Frederick Morrow and Ernest Lambert. xiv and 239 pp. Ills., index. Meiklejohn & Son, London, 1913. 2s. 6d. 7½ x 5.

This closely approaches an elementary field manual for students of surveying and mapping. Beginning with a consideration of measurements and directions, it proceeds step by step through the elements of field surveying, determination of heights and distances, mapping, the use of contours, the making and understanding of the government ordnance maps, the determination of latitude and longitude, weather observations and records, and concludes with a consideration of the shape, size and motions of the earth, the sun and the moon. For students who are looking forward to topographic surveying, mapping, etc., such a course as this book provides would be ideal. For teachers who desire to make geography a somewhat exact science and thereby get from it more mental discipline than is ordinarily sought in geography classes, the book would be useful. R. H. WHITBECK.

A Scientific Geography. Book 8: South America. By Ellis W. Heaton. 90 pp. Maps, index. Ralph, Holland & Co., London, 1912. 1s. 7½ x 5.

A type of book somewhat common in the British schools but with which we are not familiar in this country. There are seventy-nine pages before the appendix is reached. It is scientific only in a qualified sense, containing more geology and physiography than our elementary books do. The only illustrations are twenty-one sketch maps and diagrams. The causal relations between climate, topography and soil on one hand and products on the other are consistently pointed out. A considerable number of errors have slipped through the proof-reader, *e. g.*, "Colombo" for Colombia, and "west latitude" for west longitude. The book would not be useful in our schools. R. H. WHITBECK.

The British Isles, with Outlines of Physical Geography. By G. C. Fry. xi and 174 pp. Maps, index. University Tutorial Press, London, 1912. 1s. 6d. 7½ x 5.

One of the numerous small geographies produced in England and designed mainly to supply facts with which to pass examinations. Like all of the books of its type, it compresses many facts and definitions into small space. However, a rational treatment of the leading facts is attempted and underlying causes are frequently well brought out, as, for example, in the section on "Town Sites." The relation of geography to history in the British Isles is often shown rather effectively. Each chapter is followed by a set of questions mostly selected from papers set in the Local Examinations. The book would be useful for supplementary work in any of our schools which desired to lay more stress on the British Isles than American text books ordinarily do. R. H. WHITBECK.

Atlas Notes. By J. C. Chute. 82 pp. Oxford University Press, London, 1913. 1s. 7½ x 5.

This book, attempting to cover the essentials of the geography of the world in eighty-two small pages, could have no conceivable use in an American school. The author states that "The treatment is on lines of the Army Examinations." Possibly it might, if accurate, serve some use in cramming for an examination. If other parts are as inaccurate as the part dealing with the United States the book will not strengthen the students' knowledge of geography. Many of these inaccuracies are relatively of little moment, but they are not signs of a careful writer. R. H. WHITBECK.

GENERAL

Letters and Recollections of Alexander Agassiz. With a Sketch of his Life and Work. Edited by G. R. Agassiz. vii and 454 pp. Maps, ills., index. Houghton Mifflin Co., New York, 1913. $3.50. 9 x 6.

This volume is a medley of business and science and personal comment on polities and mining and coral reefs and marine invertebrates, in short a record of a most active career which will be treasured by the intimates of the second Agassiz. Agassiz dismisses Darwin somewhat too curtly in a mere note that he had never spent more than ten days on coral. At somewhat greater length he expresses wonder that Dana could know so little after the many months he had spent on coral reefs. One could wish that Agassiz had been more accurate in his geographical nomenclature while thus disposing of his great predecessors, for some of the island names which he uses are not to be found on any chart. After making due allowance for chirography and the ways of proof-readers we find clear evidence that there was a strain of inaccuracy in himself. In writing of the marine worm palolo, which he misspells, and at the same time misspells the name of the Fijian island at which he observed the annual phenomenon, he observes that only recently had it been called to the attention of naturalists. Yet it had been named fifty years earlier by J. E. Gray, and even then was being monographed by his own assistant, Woodworth. WILLIAM CHURCHILL.

Obed Hussey, Who, of All Inventors, Made Bread Cheap. Edited by Follett L. Greeno. 228 pp. Ills. F. L. Greeno, Rochester, N. Y., 1912. 8 x 5½.

Hussey patented his reaping machine in 1833, demonstrated its practicability and it was successful from the first. The fundamental principles of all harvesting machinery to-day were supplied by Hussey's machine. He was not, however, a man of busines acumen, his interests were not well looked after and rivals secured most of the honor and the profit that should have been his portion. This book records his struggles, his reaper and its success and the methods by which his ideas built up the prosperity of others than himself. The narrative is based upon the citation of evidence as to the priority of Hussey's claims and the great merits of his invention as demonstrated and recorded both in the United States and England.

A Journey to the Earth's Interior, or, Have the Poles Really Been Discovered? By Marshall B. Gardner. 69 pp. Ills. The author, Aurora, Ill., 1913. 8½ x 5½.

More pathetic than amusing. The author has theoretically discovered a hole embracing most of the interior of the earth and passing from Pole to Pole through the earth's center. He has provided it with a central sun whose beams, escaping from the northern and southern orifices, account for the phenomena of the aurora borealis and the aurora australis; and he bolsters his theory farther with red snow, driftwood in high latitudes, the dip of the needle, the migrations of Polar animals, etc., some of which phenomena have been fully explained and others are not exactly what he describes them to be. All this is set forth very seriously and the work is "dedicated to the continued progress of science and the service that it can render to humanity."

Papers on Inter-Racial Problems. Communicated to the First Universal Races Congress held at the University of London, July 26-29, 1911. Edited by G. Spiller. xvi and 485 pp. Index. World Peace Foundation, Boston, 1911. 10 x 6½.

In this volume are some sixty essays which were proposed for consideration at the first Universal Races Congress in London in 1911. They represent the attitude with which distinguished authorities approached that informing meeting. Of any single paper in the collection we may say that it offers the fullest possible statement of principles short of the point where controversy must arise and where further development becomes matter of argument against fixed convictions. WILLIAM CHURCHILL.

OTHER BOOKS RECEIVED

These notes do not preclude more extended reference later

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THE LOWERY COLLECTION: A descriptive list of maps of the Spanish possessions within the present limits of the United States, 1502-1820. By W. Lowery. Edited with notes by P. L. Phillips. x and 567 pp. Index. Library of Congress, Washington, 1912. $1. 10 x 7½.

THE HISTORY OF GEORGIA. Containing brief sketches of the most remarkable events up to the present day (1784). By Capt. Hugh M'Call. x and 565 pp. Index, ill., 1811. Reprinted by A. B. Caldwell, Atlanta, Ga., 1909. $4.25. 9½ x 6½.

THE HOLLANDERS OF IOWA. By Jacob Van der Zee. 453 pp. Index. Historical Soc. of Iowa, Iowa City, 1912. $3. 9 x 6.

ILLUSTRATED HISTORY OF NEW MEXICO. By B. M. Read. Translated into English, under the direction of the author, by E. Baca. 804 pp. Ills., index. B. M. Read, Santa Fé, N. M., 1912. $10. 10 x 7.

THE IMMIGRANT INVASION. By Frank J. Warne. 336 pp. Ills., index. Dodd, Mead & Co., New York, 1913. $2.50. 8½ x 5½.

THE INDIAN TRIBES OF THE UPPER MISSISSIPPI VALLEY and Region of the Great Lakes as described by Nicholas Perrot, French commandant in the Northwest; Bacqueville de la Potherie, French royal commissioner to Canada; Morrell Marston, American army officer; and Thomas Forsyth, U. S. agent at Fort Armstrong. Translated, edited, annotated, and with bibliography by E. H. Blair. Vol. 1: 372 pp. Vol. 2: 412 pp. Map, ills., index. A. H. Clark Co., Cleveland, O., 1912. 9½ x 6½.

HISTORICAL NARRATIVES OF PUGET SOUND, HOOD'S CANAL, 1865-1885. The experience of an only free man in a penal colony. By E. Clayson, Sr. 106 pp. The author, Seattle, Wash. 50 cts. 7½ x 5½.

LAKE GEORGE AND LAKE CHAMPLAIN. The war trail of the Mohawk and the battleground of France and England in their contest for the control of North America. By W. M. Reid. xviii and 381 pp. Maps, ills., index. G. P. Putnam's Sons, New York, 1910. $3.50. 9½ x 7.

SAN FRANCISCO, as it was, as it is, and how to see it. By Helen T. Purdy. x and 221 pp. Maps, ills. P. Elder & Co., San Francisco, 1912. $2.50. 9 x 7.

THE CANADIAN ALMANAC AND MISCELLANEOUS DIRECTORY FOR 1913. Containing full and authentic commercial, statistical. . . . and general information. Edited by A. W. Thomas. 520 pp. Maps, index. Copp, Clark Co., Toronto, 1913. 9 x 6.

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FRENCH CANADA AND THE ST. LAWRENCE. Historic, picturesque and descriptive. By J. C. Hopkins. 431 pp. Ills., index. J. C. Winston Co., Philadelphia, 1913. $3. 8 x 5½.

THE HISTORY OF NEW FRANCE. By Marc Lescarbot. With an English translation, notes and appendices by W. L. Grant and an introduction by H. P. Biggar. Vol. 1: xxi and 331 pp. Vol. 2: vii and 584 pp. Maps. The Champlain Soc., Toronto, 1907 and 1911. 8½ x 7.

IN THE HEART OF OLD CANADA. By William Wood. xiii and 310 pp. William Briggs, Toronto, 1913. $1.50. 8 x 5½.

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NEW MAPS

EDITED BY THE ASSISTANT EDITOR

For system of listing maps see p. 74 of this volume

MAPS ISSUED BY UNITED STATES GOVERNMENT BUREAUS

U. S. GEOLOGICAL SURVEY

Topographic Sheets

(Including Combined and Special Topographic Maps)

Alabama-Georgia. Seale Quadrangle.* Surveyed in 1910-1911. 1:62,500. 32°30′ - 32°15′ N.; 85°15′ - 85°0′ W. Contour interval 20 ft. Edition of Mar. 1914.

California. (a) Brentwood Quad. Surveyed in 1911. 1:31,680. 38°0′0″ - 37°52′30″ N.; 121°45′0″ - 121°37′30″ W. Interval 5 ft. Edit. of Feb. 1914.

(b) Caliente Quad.* Surveyed in 1910-1912. 1:125,000. 35°30′ - 35°0′ N.; 119°0′ - 118°30′ W. Interval 100 ft. Edit. of May 1914.

(c) Capitola Quad.* Surveyed in 1911-1912. 1:62,500. 37°0′ - 36°45′ N.; 122°0′ - 121°45′ W. Interval 25 ft. Edit. of April 1914.

(d) Cholame Quad. Surveyed in 1907-1908. 1:125,000. 36°0′ - 35°30′ N.; 120°30′ - 120°0′ W. Interval 100 ft. Preliminary edition, Mar. 1914.

(e) Folsom Quad. Surveyed in 1908. 1:31,680. 38°45′0 - 38°37′30″ N.; 121°15′0″ - 121°7′30″ W. Interval 5 ft. Preliminary edition, Feb. 1914.

(f) Hamilton Quad. Surveyed in 1904. 1:31,680. 39°45′0″ - 39°37′30″ N.; 122°7′30″ - 122°0′0″ W. Interval 5 ft. Edit. of Feb. 1914.

(g) Kirkwood Quad. Surveyed in 1904. 1:31,680. 39°52′30″ - 39°45′0″ N.; 122°15′0″ - 123°7′30″ W. Interval 5 ft. Edit. of Mar. 1914.

(h) Lost Hills Quad. Surveyed in 1907-1908. 1:125,000. 36°0′ - 35°30′ N.; 120°0′ - 119°30′ W. Interval 100 ft. Preliminary edition, Feb. 1914.

(i) McIntosh Landing Quad. Surveyed in 1904. 1:31,680. 39°52′30″ - 39°45′0″ N.; 122°7′30″ - 122°0′0″ W. Interval 5 feet. Edit. of Mar. 1914.

(j) Orland Quad. Surveyed in 1904. 1:31,680. 39°45′0″ - 39°37′30″ N.; 122°15′0″ - 122°7′30″ W. Interval 5 ft. Edit. of Mar. 1914.

[Maps (a), (e), (f), (g), (i) and (j) belong to the two-inches-to-the-mile map of the San Joaquin-Sacramento Valley; the northeastern half of map (e) is blank. The western two-thirds of map (d) and the eastern three-fifths of map (h) are likewise blank. On map (c) the green tint differentiates between (1) timber, (2) timber and brush and (3) brush.]

Colorado. Meeker Quad. Surveyed in 1911-1912. 1:62,500. 40°15′ - 40°0′ N.; 108°0′ - 107°45′ W. Interval 50 ft. Edit. of Feb. 1914.

[Coextensive with the southwestern corner of the Danforth Hills special sheet, 1:125,000, published in 1910, which is a reprint of the topographic base of a geologic map in *U. S. G. S. Bull. 415*.]

Illinois. Centralia Quad.* Surveyed in 1908 and 1912. 1:62,500. 38°45′ - 38°30′ N.; 89°15′ - 89°0′ W. Interval 10 ft. Edit. of April 1914.

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* On these sheets woods are shown in green.

Iowa. Madrid Quad.* Surveyed in 1911. 1:62,500. 42°0′ - 41°45′ N.; 94°0′ - 93°45′ W. Interval 20 ft. Edit. of April 1914.

Kentucky. Dunmor Quad.* Surveyed in 1911. 1:62,500. 37°15′ - 37°0′ N.; 87°0′ - 86°45′ W. Interval 20 ft. Edit. of Feb. 1914.

Louisiana. Baxter Bayou Quad.* Surveyed in 1909 and 1911. 1:31,680. 32°52′30″ - 32°45′0″ N.; 91°22′30″ - 91°15′0″ E. Interval 5 ft. Preliminary edition, Mar. 1914.

[Belongs to the series of two-inches-to-the-mile maps of the alluvial valley of the Mississippi of which the others were listed in the *Bull.:* under "Louisiana," Vol. 43, 1911, p. 75, Vol. 44, 1912, p. 398, Vol. 45, 1913, pp. 476 and 555-556; and under "Mississippi," Vol. 43, 1911, p. 75 and Vol. 45, 1913, pp. 476. The western quarter of the present map is blank.]

Maine. (a) Bethel Quad.* Surveyed in 1911-1912. 1:62,500. 44°30′ - 44°15′ N.; 71°0′ - 70°45′ W. Interval 20 ft. Edit. of April 1914.

(b) Bryant Pond Quad.* Surveyed in 1911. 1:62,500. 44°30′ - 44°15′ N.; 70°45′ - 70°30′ W. Interval 20 ft. Edit. of Feb. 1914.

Mississippi–Alabama–Tennessee. Iuka Quad.* Surveyed in 1909 and 1911. 1:62,500. 35°0′ - 34°45′ N.; 88°15′ - 88°0′ W. Interval 20 ft. Edit. of Feb. 1914.

Missouri. (a) Green City Quad.* Surveyed in 1911-1912. 1:62,500. 40°30′ - 40°15′ N.; 93°0′ - 92°45′ W. Interval 20 ft. Edit. of April 1914.

(b) Smithville Quad.* Surveyed in 1912. 1:62,500. 39°30′ - 39°15′ N.; 94°45′ - 94°30′ W. Interval 20 ft. Edit. of April 1914.

[Map (b) coextensive with the northeast quarter, of the old Kansas City, Kan.-Mo., sheet, 1:125,000, originally surveyed in 1885 and 1887.]

Montana. Brockton Quad.* Surveyed in 1910-1911. 1:62,500. 48°15′ - 48°0′ N.; 105°0′ - 104°45′ W. Interval 20 ft. Edit. of Mar. 1914.

New Mexico. Alamo National Forest.* Surveyed in 1909-1911. 1:250,000. 33°30′ - 32°30′ N.; 106°0′ - 105°0′ W. Interval 200 ft. Edit. of Feb. 1914.

[Outside of the Alamo National Forest and the Mescalero Apache Indian Reservation the sheet is blank.]

New Mexico–Colorado. Raton Quad.* Surveyed in 1911-1912. 1:62,500. 37°0′ - 36°45′ N.; 104°30′ - 104°15′ W. Interval 50 ft. Edit. of May 1914.

Ohio. (a) Bryan Quad.* Surveyed in 1911. 1:62,500. 41°30′ - 41°15′ N.; 84°48′ - 84°30′ W. Interval 10 ft. Edit. of Feb. 1914.

(b) Celina Quad.* Surveyed in 1911. 1:62,500. 40°45′ - 40°30′ N.; 84°48′ - 84°30′ W. Interval 10 ft. Edit. of Mar. 1914.

(c) Navarre Quad.* Surveyed in 1911. 1:62,500. 40°45′ - 40°30′ N.; 81°45′ - 81°30′ W. Interval 20 ft. Edit. of Mar. 1914.

(d) Paulding Quad.* Surveyed in 1911. 1:62,500. 41°15′ - 41°0′ N.; 84°48′ - 84°30′ W. Interval 10 ft. Edit. of Feb. 1914.

[Maps (a), (b) and (d) are extended beyond the limits of a sheet of regular size so as to include all the area to the Indiana-Ohio boundary on the west.]

Ohio–Michigan. (a) Pioneer Quad.* Surveyed in 1911. 1:62,500. 41°45′ - 41°30′ N.; 84°48′ - 84°30′ W. Interval 10 ft. Edit. of Mar. 1914.

(b) Swanton Quad.* Surveyed in 1911. 1:62,500. 41°45′ - 41°30′ N.; 84°0′ - 83°45′ W. Interval 10 ft. Edit. of Mar. 1914.

[Map (a) is extended beyond the regular limits similar to maps (a), (b) and (d) of the previous entry.]

Texas. Gay Hill Quad. Surveyed in 1911. 1:62,500. 30°30′ - 30°15′ N.; 96°30′ - 96°15′ W. Interval 25 ft. Edit. of Mar. 1914.

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* On these sheets woods are shown in green.

XUM

West Virginia. (a) Big Bend Quad.* Surveyed in 1912. 1:62,500. 37°45′ - 37°30′ N.; 81°0′ - 80°45′ W. Interval 50 ft. Edit. of April 1914.

(b) Eccles Quad.* Surveyed in 1911. 1:62,500. 38°0′ - 37°45′ N.; 81°30′ - 81°15′ W. Interval 50 ft. Edit. of Feb. 1914.

(c) Flattop Quad.* Surveyed in 1911. 1:62,500. 37°45′ - 37°30′ N.; 81°15′ - 81°0′ W. Interval 50 ft. Edit. of Mar. 1914.

[Coextensive respectively with the southeastern quarter of the old Hinton sheet, 1:125,000, surveyed in 1886-8, and the northwestern and the southeastern quarters of the old Raleigh sheet, 1:125,000, originally surveyed in 1883-85 and resurveyed in 1894-95.]

Wyoming. (a) Cheyenne Quad. Surveyed in 1911. 1:125,000. 41°30′ - 41°0′ N.; 105°0′ - 104°30′ W. Interval 50 ft. Edit. of Feb. 1914.

(b) Hanna Quad. Surveyed in 1911-1912. 1:62,500. 42°0′ - 41°45′ N.; 106°45′ - 106°30′ W. Interval 25 ft. Edit. of Mar. 1914.

(c) Walcott Quad. Surveyed in 1912. 1:62,500. 42°0′ - 41°45′ N.; 107°0′ - 106°45′ W. Interval 25 ft. Edit. of April 1914.

[Maps (b) and (c) coextensive respectively with the northeastern and northwestern quarters of the Fort Steele sheet, 1:125,000, surveyed in 1891.]

U. S. Coast and Geodetic Survey†

North Carolina. (a) Pamlico Sound: Western Part. 1:80,000. 35°41′ - 34°56′ N.; 76°42′ - 75°58′ W. 1 color. With inset: Continuation of Bay River. 1:80,000. 35°11′ - 35°5′ N.; 76°47′ - 76°41′ W. 1 color. Chart No. 1231. Feb. 1914. Price 50 cts.

(b) Cape Hatteras: Wimble Shoals to Ocracoke Inlet. 1:80,000. 35°34′ - 35°0′ N.; 76°5′ - 75°10′ W. 1 color. Chart No. 1232. April 1914. 50 cts.

[These two charts together cover approximately the area shown on previous Charts Nos. 142, 143, 144[1] and 144[2].]

Oregon-Washington. (a) Columbia River: Entrance to Harrington Point. 1:40,000. 46°20′ - 46°7′ N.; 124°14′ - 123°40′ W. 1 color. Chart No. 6151. May 1914. 50 cts.

(b) Columbia River: Harrington Point to Grims Island. 1:40,000. 46°20′ - 46°6′ N.; 123°40.7′ - 123°7.8′ W. Chart No. 6152. April 1914. 50 cts.

(c) Columbia River: Grims Island to St. Helens. 1:40,000. 46°12.1′ - 45°51.2′ N.; 123°8.2′ - 122°43.0′ W. Chart No. 6153. 50 cts.

[These three charts together cover approximately the section of the Columbia shown on previous Charts Nos. 6140-6144.]

Pennsylvania-New Jersey. Delaware River: Philadelphia to Trenton. 1:40,000. 40°13.6′ - 39°58.8′ N.; 75°4.6′ - 74°41.9′ W. 1 color. With inset: Trenton. 1:20,000. 40°13.7′ - 40°11.0′ N.; 74°47′ - 74°44′ W. 1 color. Chart No. 296. April 1914. 50 cts.

[Replaces, on twice the scale, the inset on Chart No. 126 (see *Bull.*, Vol. 43, 1911, p. 545.]

Philippine Islands. (a) Harbors of Samar and Leyte. [Five maps, all one color:] (1) Port Palompon, West Coast of Leyte. Surveyed 1906. 1:10,000. 11°4′ - 11°2′ N.; 124°21.4′ - 124°23.7′ E. (2) Biliran Strait, North Coast of Leyte. Surveyed 1908. 1:20,000. 11°29′ - 11°26′ N.; 124°26.6′ - 124°31.2 E. (3) Parasan Harbor, West of Samar. Surveyed 1910. 1:10,000. 11°42′ N. and 124°45′ E. (4) Santo Niño Harbor, North Coast of Santo Niño I., West of Samar. Surveyed in 1912. 1:5,000. 11°55′45″ N. and 124°27′ E. (5) Jibatan River, West Coast of Samar. Surveyed in 1912. 1:50,000. 12°6′ N. and 124°32′ E. Chart No. 4456. April 1914. 30 cts.

(b) Visayan Sea. [1:200,000]. 11°55′ - 10°40′ N.; 122°34′ - 124°25′ E. 1 color. Chart No. 4405. Mar. 1914. 50 cts.

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* On these sheets woods are shown in green.

† Only new charts are listed, not new editions of old charts.

South Carolina-Georgia-Florida. Charleston Light to Cape Canaveral. [Mean meridional scale 1:450,000]. 32°43′ - 28°27′ N.; 81°40′ - 78°7′ W. Chart No. 1111. April 1914. 50 cts.

[Comprises about the same area as Charts Nos. 12 and 13.]

Porto Rico. (a) Culebra Island and Approaches, West Indies. 1:20,000. 18°22.8′ - 18°14.4′ N.; 65°23.8′ - 65°11.7′ W. 2 colors. Chart No. 914. Feb. 1914. 50 cts.

(b) Target Bay and Vicinity, Culebra Island. 1:10,000. 18°19.7′ - 18°16.4′ N.; 65°21.0′ - 65°15.8′ W. 1 color. Chart No. 915. Mar. 1914. 25 cts.

(c) Great Harbor, Culebra Island. 1:6,500. 18°19′9″ - 18°16′23″ N.; 65°18′34″ - 65°15′4″ W. Chart No. 913. Mar. 1914. 50 cts.

ASIA

Japan. [Two maps:] (1) Vulkanische Zonen des Aso und Kirischima auf Kiuschiu. [1:2,000,000]. 34° - 31° N.; 129⅛° - 132° E. 2 colors. (2) Geologische Übersicht der Umgebung des Vulkans Sakurajima. 2 colors. Nach K. Nakajima. 1:200,000. [31⅜° N. and 130⅜° E.] Accompany, on Taf. 24, "Der verheerende Ausbruch des Vulkans Sakurajima im Süden der japanischen Insel Kiuschiu" by K. Nishio and I. Friedlaender, *Petermanns Mitt.*, Vol. 60, I, 1914, March, pp. 132-133.

AUSTRALASIA AND OCEANIA

Australia. (a) Sketch Map of South East Australia Showing the Position of the Federal Territory among the Three Massifs. 1:10,000,000. 30½° - 40° S.; 143° - 154° E.

(b) Sketch Map of Australia Showing the Relation of the Population to the Rainfall & Tropics, Based on Government Data. 1:30,000,000. 10° - 43° S.; 110° - 160° E.

(c) Diagrams [of Australia] Showing the Relation of "Canberra" to the Summer and Winter Rain "Crescents." [1:40,000,000]. [10° - 43° S.; 110° - 155° E.] (1) January Isohyets. (2) July Isohyets.

(d) Sketch Map of South East Australia Showing the Position of the Rival Sites. 1:10,000,000. 30½° - 40° S.; 143° - 154° E.

(e) The Salient Geological Features of the Federal Territory, by Taylor & Mahony. 1:750,000. 34°58′ - 35°57′ S.; 148°46′ - 149°40′ E.

(f) Approximate Contours in the Northern Part of the Federal Territory. 1:750,000. 34°58′ - 35°42′ S.; 148°45′ - 149°42′ E.

(g) The Physiographic Divisions of the Federal Territory. 1:750,000. 34°58′ - 35°42′ S.; 148°45′ - 149°42′ E.

(h) Sketch Map of the Federal Territory to illustrate the paper by Griffith Taylor, B.Sc., B.E., B.A., F.G.S. 1:400,000. 35°8′ - 35°57′ S.; 148°46′ - 149°24′ E. 2 colors.

Accompany respectively as Figs. 1, 2, 3, 4, 5, 6, 8A, on pp. 379, 381, 383, 386, 388, 390 and 394, and as separate plate, "The Evolution of a Capital: A Physiographic Study of the Foundation of Canberra, Australia" by G. Taylor, *Geogr. Journ.*, Vol. 43, 1914, No. 4, pp. 378-395.

[Map (a) shows relief by 1,000 and 3,000 ft. contours. Three population density grades distinguished on map (b): (1) less than, (2) more than 1 person in 4 sq. miles and (3) over 4 persons per sq. mile, and 5 sizes of towns shown. On map (f) the following elevations are indicated: under 1,900 ft., 1,900-2,400 ft., more than 2,400 ft. On the general topographic map (h) relief is in brown shading and drainage in blue.]

Dutch New Guinea. Sketch Map to illustrate Explorations in Dutch New Guinea by A. F. R. Wollaston, M.A., M.B., 1912-13. 1:800,000. 4° - 5° S.; 137°0′ - 137°31′ E. 2 colors. With inset showing location of main map.

Accompanies "An Expedition to Dutch New Guinea" by A. F. R. Wollaston, *Geogr. Journ.*, Vol. 43, 1914, No. 3, pp. 248-273.

[Route led up the Setakwa and the headwaters of the Utakwa River nearly to the top of Mt. Carstensz in the Nassau Range. Relief shows in brown shading.]

Papua (British New Guinea). Sketch Map showing the routes followed by W. M. Beaver in the Girara District, Western Papua, 1910-13. 1:400,000. 7°47′-8°33′ S.; 142°51′-143°47′ E. 1 color. With inset, 1:30,000,000, showing location of main map. Accompanies "A Description of the Girara District, Western Papua," by W. M. Beaver, *Geogr. Journ.*, Vol. 43, 1914, No. 4, pp. 407-413.

[District lies in the coastal lowland on the northern side of the estuary of the Fly River.]

WORLD AND LARGER PARTS

World. [Two hemispheres:] (1) Erdkarte in mittabstandstreuer Azimutalprojektion mit dem Mittelpunkt Strassburg. Berechnet und entworfen von Prof. Dr. Emil Rudolph und Dr. Siegmund Szirtes. 1:38,000,000. 3 colors. (2) Erdkarte in mittabstandstreuer Azimutalprojektion mit dem Antipodenpunkt von Strassburg als Mittelpunkt. Berechnet und entworfen von Prof. Dr. Emil Rudolph und Dr. Siegmund Szirtes. 1:38,000,000. 3 colors. Accompany, as Taf. 27 and 28, "Zur Erklärung der geographischen Verteilung von Grossbeben" by E. Rudolph and S. Szirtes, *Petermanns Mitt.*, Vol. 60, I, 1914, March, pp. 124-130, and April, pp. 184-189.

[Two hemispheres on the equidistant azimuthal (Postel's) projection to facilitate the location of earthquakes registered at the seismological station in Strassburg. Circles of distance are drawn for every 1,000 kilometers, and azimuth lines for every 10°. As the reviewer has pointed out (*Ann. Assoc. Amer. Geogrs.*, Vol. II, 1912, pp. 49-54), the use of Postel's projection for this purpose is entirely correct in principle and has the advantage over the stereographic, whose use was there suggested because it can be more easily drawn, in that the interval between the circles of distance remain the same, while on the stereographic projection it becomes twice as much on the margin as at the center. At all events, it is very gratifying to see that the inappropriate use of Mercator's projection for such maps—which was commented on in "New Maps" under "World" in the *Bull.*, Vol. 43, 1911, p. 879—is gradually being discarded. On the present map, in addition, are shown: volcanoes, active and inactive, tectonic lines, and the epicenters and areas of influence of major earthquakes. Proper editing would have eliminated the obsolete representation of northeast Greenland and the coast of Victoria Island as well as the ultra-conservative treatment of the Antarctic Continent.]

Other Maps Received

NORTH AMERICA

United States

Connecticut. Map of Connecticut, prepared by U. S. Geological Survey in cooperation with the State of Connecticut. 1:125,000. U. S. Geological Survey, Washington, D. C., 1893, reprinted 1912.

Kentucky. (a) [Twelve county maps on the scale of 2 miles to the inch, all, except (1), by J. B. Hoeing, viz.:] (1) Warren County, 1891, by J. E. McAdoo; (2) Meade and Breckenridge Counties, 1891; (3) Henry, Shelby and Oldham Counties; (4) Washington and Marion Counties; (5) Clinton County; (6) Boyle and Mercer Counties; (7) Bath and Fleming Counties; (8) Madison County; (9) Montgomery and Clark Counties; (10) Lincoln County; (11) Spencer and Nelson Counties; (12) Mason County. The Kentucky Geological Survey, Frankfort, Ky.

(b) Map of the Jackson Purchase, comprising Ballard, McCracken, Marshall, Graves, Calloway, Hickman and Fulton Counties, by J. B. Hoeing. 2 miles to the inch. The Kentucky Geological Survey, Frankfort, Ky., 1885.

(c) Jackson Purchase. 1:300,000. The Kentucky Geological Survey, Frankfort, Ky., 1886.

(d) Map of the Big Sandy Valley, by J. B. Hoeing. 4 miles to the inch. The Kentucky Geological Survey, Frankfort, Ky., 1905.

(e) Map of Cumberland Mountain System, by J. B. Hoeing. 4 miles to the inch. The Kentucky Geological Survey, Frankfort, Ky., 1891.

(f) Preliminary Geological Map of Kentucky, by J. B. Hoeing. 10 miles to the inch. The Kentucky Geological Survey, Frankfort, Ky., 1907.

Oklahoma. Indian Territory, surveyed under the direction of Charles H. Fitch, topographer, 1895-1899. 1:500,000. U. S. Geological Survey, Washington, D. C., 1902.

Western States. [Maps showing] Lands Designated by the Secretary of the Interior as Subject to Entry Under the Provisions of the Enlarged Homestead Act of Feb. 19, 1909, on the scale of 1 inch to 24 miles: States of Montana, Wyoming, Nevada, Oregon, Utah, Colorado, and North Dakota, and Territories of Arizona and New Mexico. Department of the Interior, Washington, D. C., 1912.

CANADA

Alberta. Southern Alberta. Map showing disposition of lands. 1:792,000. Railway Lands Branch, Department of the Interior, Ottawa, 1914.

British Columbia. Map 43A: Sooke sheet, Vancouver Island, 1:125,000; 92A: Coast and Islands between Queen Charlotte Sound and Burke Channel, 1:253,440. Geological Survey of Canada. Department of Mines, Ottawa, 1914.

New Commercial Map of British Columbia. 1:1,520,640. Insets: Vancouver District; Geological map of British Columbia; Southeast Vancouver Island. Carl Pitner & Co., Ltd., Vancouver, B. C.

Manitoba. Cereal map of Manitoba, showing acreage under crop in each township in wheat, oats, barley and flax. 1:792,000. Department of the Interior, Ottawa, 1914.

Ontario. Stovel's Railway, Commercial Routing and Shippers' Map of Ontario. Inset: Section showing railways between Fort William and North Bay. The Stovel Co., Winnipeg, 1910.

Saskatchewan. Saskatchewan: Map Showing Disposition of Lands. Corrected to Jan. 1st, 1914. 1:792,000. Railway Lands Branch, Department of the Interior, Ottawa.

AFRICA

British East Africa. East Africa Protectorate: General Plan. 1:1,500,000. Survey Department, Cadastral Branch, Nairobi, B. E. A.

Mombasa-Victoria (Uganda) Railway and Busoga Railway. 1:15,000,000. The Director of Surveys, Nairobi, B. E. A., 1913.

Rhodesia. British Central Africa: 1:250,000. Sheet 105-G, Songwe River; 105-K, Nyika Plateau; 111-F, Fort Manning; 111-G, Dowa; 111-H, Fort Maguire; 111-K, Dedza Boma; 111-L, Mlangeni; 111-O, Kirk Mountains; 111-P. Blantyre; 117-D, Chiromo; 117-H, Sena. Corrected to 1902. Surveyor-General's Office, Salisbury, Rhodesia.

Map of Southern Rhodesia in 11 sheets. 5 miles to the inch. The Surveyor-General's Office, Salisbury, Rhodesia, 1914. Price £3.

French Equatorial Africa. Côte ouest d'Afrique. (1) De l'Estuaire du Gabon à la Baie de Pointe Noire; (2) Bas-Ogooué [showing 22 lakes], 1:50,000; (3) Baie de Pointe Noire, 1:10,000, 1910; (4) Baie du Cap Lopez, Mouillage de Mandji, 1:10,000, 1911. Mission Hydrographique du Gabon, Ministère des Colonies, Paris.

XUM

ASIA

India. Military traffic map of India. 1 in.=64 mi. Survey of India Office, Calcutta [1914]. Price 1 rupee 8 annas.

[Survey of India]. Sheet 2 M/15, Parts of Dindings Territory and Lower Perak District; 2 M/11, Parts of Dindings Territory, K. Kangsar & L. Perak Districts; 2 M/7, Parts of Matang, Kuala Kangsar, Larut Districts & Dindings Territory. 1:63,360. Survey of India Office, Calcutta, 1912. Price $2.50 each.

AUSTRALASIA AND OCEANIA

Tasmania. Sketch map, General geological features of Tasmania. 15 miles to the inch. Surveyor-General's Office, Hobart.

Victoria. Murmungee. 40 chains to the inch. Geological Survey of Victoria. [Melbourne], 1914.

Wagra. 40 chains to the inch. Geological Survey of Victoria. [Melbourne], 1914.

EUROPE

Germany. Rhein-Maas-Schelde-Kanal. (a) Entwurf Hentrich 1899, Uebersichtskarte, 1:1,000,000. (b) Lageplan, 1:200,000. Worms & Lüthgen, Crefeld, 1913.

Geologische Karte von Preussen und benachbarten Bundesstaaten. 1:25,000. Lieferung 184: Blatt Hünfeld, Grad-Abteilung 69 no. 21; Blatt Tann, Grad-Abteilung 69 no. 23; Blatt Fulda, Grad-Abteilung 69 no. 27; Blatt Weyhers, Grad-Abteilung 69 no. 33. Königlich Preussische Geologische Landesanstalt, Berlin, 1912.

Greece. Map of Greek Kingdom [in Greek], 1:75,000. Sheets: Neochorion, Tsagesi, Aguia, Aidepsos, Koniskos-Helasson, Rapsane-Tempe, Trikkala, Larissa. Greek General Staff, Athens.

Iceland. Generalstabens Topografiske Kort [of Iceland]. 1:50,000. Sheet 3 N.V. Látrabjard; 13 S.V. Siglunes; 13 N.A. Brjánslaekur; 23 N.V. Vattarnes; 23 N.A. Porskafjördur; 33 S.A. Hrútafjördur; 33 N.V. Tröllatunga; 33 N.A. Broddanes; 34 S.A. Hrútafjardará; 34 N.A. Bordeyri; 34 N.V. Asgardur; 34 S.V. Kvennabrekka; 35 N.A. Fornihvammur. Generalstabens topografiske Afdeling, Kjöbenhavn. 1914.

EDUCATIONAL

Gold Coast. Wall map of the Gold Coast Colony, Ashanti and the Northern Territories. Prepared for the use of the Gold Coast Government schools by Major F. G. Guggisberg, C.M.G. 1:400,000. Surveyor-General's Office, Accra, Gold Coast Colony, 1908.

Erratum

Colorado. Mr. R. D. George, State Geologist of Colorado, kindly calls attention to the following corrections of statements made in the review of the topographic and the geologic map of Colorado, 1:500,000, in the *Bulletin* for April (Vol. 46, 1914), p. 315: (1) The base used for these maps was prepared by the Colorado Geological Survey; (2) the physical features of the Denver area are shown on the topographic map within the range of expression (5,500 ft. contour and drainage) and the most important cultural features are shown in an insert on the margin of the map; (3) including all differentiation, by color, pattern and symbol, 145 sedimentary formations, 55 types of igneous and 11 types of metamorphic rocks are distinguished on the geologic map; (4) the areas shown in detail on this map include the results of all recent detailed geological work of the United States Geological Survey and the Colorado Geological Survey to January, 1912.